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The Management Of Feral Pig Socio-Ecological Systems In Far North Queensland, Australia

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THE MANAGEMENT OF FERAL PIG SOCIO-ECOLOGICAL SYSTEMS IN FAR NORTH QUEENSLAND, AUSTRALIA

by

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Dedication

This study would not be possible without the collaboration and support of the farmers, hunters and traditional land owners of the Cassowary Coast Regional Council, QLD Australia. This is as much their dissertation as it is mine. I greatly appreciate the time and effort they took from their busy lives to reflect on the feral pigs that impact their lives and livelihoods.

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Abstract

The development of management programs for socio-ecological systems that include multiple stakeholders is a complex process and requires careful evaluation and planning. This is particularly a challenge in the presence of intractable conflict. The feral pig (*Sus scrofa*) in Australia is part of one such socio-ecological system. There is a large and heterogeneous group of stakeholders interested in pig management. Pigs have diverse effects on wildlife and plant ecology, economic, health, and social sectors.

This study used the feral pig management system as a vehicle to examine intractable conflict in socio-ecological systems. The purpose of the study was to evaluate: (a) stakeholder beliefs and values about pig management, (b) stakeholder socio-political relationships, and (c) how stakeholder relationships impact management practices. I used an action research approach that included the collection of oral histories, individual interviews, sociograms, participant observation, and a survey to investigate the socio-political relevance of pigs to hunters, growers, managers, government representatives, and traditional land owners in the Cassowary Coast Council of Far North Queensland. Data was collected between 2007-2009.

Despite differences in values and beliefs, I found that stakeholder groups all consider management outcomes resulting in pig control acceptable. There are multiple socio-political barriers that impede successful application of management strategies. These barriers include poor communication, competing stakeholder social structures, limited resources, and property access. Additionally, illusory barriers compound conflict and are tied to the influence of negative stereotypes on stakeholder behavior. The use by managers, of traditional management practices focusing on equilibrium resilience, conflicts with the more ecological resilience oriented

practices of other stakeholders. The result is a division of the landscape that leads to poor management outcomes.

This study describes useful tools for the engagement of stakeholders. Frame analysis can clarify the values and positions of stakeholders and suggests strategies for reframing intractable conflicts. The evaluation of stakeholder social structures provides information about the social context of management issues. It is important to operationalize participation and determine the amount of participation desired by stakeholders throughout the research process.

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Chapter 1

The First Pig: Action Research In Practice

Every grower, hunter, ranger, manager on the ground, and many others have a memory of their first feral pig, whether fond or furious. My first live pig came late one Friday night while trawling the dirt roads of a banana farm. It must have been ten or eleven o'clock at night. The hunter, his rifle, and I had been making rounds since at least 8:00 pm. We finally spotted the pigs on the road ahead in the car spotlights. They were small; some were the classic black of many feral pigs—they looked like the wild boar found in Europe. The others looked more like what you might find at a piggery: mottled orange, pink and black. There were six of them. They were running along the trail, most likely on the prowl for food or a good scratching post.

My companion quickly stopped the truck, drew out his rifle, and stepped from the car. I moved out behind him with my camera as he walked slowly toward the pigs and fired; then chaos and squeals. He had shot two. The rest ran off into the banana plants, seeming to disappear; lost to us in an instant. I watched as he gathered up the two pigs to move them off the road and tuck them away in the bush, leaving little sign that they had ever been there, except for a few hoof prints that would be gone with the morning rain. These pigs would not be saved for us to eat. There was a sense of satisfaction. The hunter had done his job by the banana grower. He was helping the farmer get rid of what he considered a pest for his bananas. The hunter was satisfied with practicing his skill and achieving at least part of his goal, even if the other pigs had gotten away. For me, that was the beginning; I had my first glimpse of the world I was delving into, and I was enjoying every minute. It took a long journey to reach that paddock, one of many

such in the far north of Queensland, Australia where I undertook my doctoral research in feral pig management. This is the story of how I got there and why it mattered.

My field of interest is social ecology as it relates to environmental management. Currently, my particular focus is on the impact of participation, communication, and the influence of social context on natural resource management conflict. I already had it in my head that I wanted a field site where I could conduct an action research study. Action research (AR) emphasizes the interactions between the researcher and the people with whom she works, resulting in the co-generation of knowledge (Greenwood and Levin 1998; Herr and Anderson 2005; Portelli 1998; Russell and Harshbarger 2003). Researchers and other relevant stakeholders work together to develop research questions, design and carry out a study, and disseminate information. As a researcher, I represent just one more participant in the study, a stakeholder with my own interests and concerns. This form of research requires constant evaluation, feedback and cycles of reflection to ensure that the principles of action research are maintained. AR requires some practical action as a result of the study (Cornwall and Jewkes 1995; Greenwood and Levin 1998; Russell and Harshbarger 2003). In this study, I worked together primarily with hunters and farmers to design and conduct this research project.

I was introduced to the 'pig problem' in Far North Queensland (FNQ) during my search for an appropriate field site for my doctoral research. In FNQ, as in many other parts of Australia, farmers and some private residents have long been trying to get the message out that someone needs to do something about 'the pig problem'. There may be as many as 13.5 million pigs inhabiting 38% of Australia (Hone 1990). FNQ is particularly an area of concern. The Wet Tropics of FNQ is estimated to hold as much as 75% of Queensland's pig populations (McGaw and Mitchell 1998). It is home to a number of rare and endangered wildlife species, including

various species of frogs and the iconic cassowary (*Casuarius spp*.; Crome and Moore 1988; McGaw and Mitchell 1998). In order to understand the problem I was introduced to, it is necessary to go back a bit further into the history books.

Feral pigs are an introduced species to Australia. They were brought by European settlers around 1788 as a food source. The introduced pigs were a domesticated species (*Sus scrofa)* and many escaped becoming the predecessors of contemporary feral pigs (Pullar 1953). The excellent habitat provided by the Wet Tropics of the Cassowary Coast Regional Council (CCRC) in FNQ and the subsequent land clearing and cultivation of crops such as sugar cane and bananas between the 1860s and 1870s, provided ideal conditions for pig populations to multiply (Choquenot et al. 1996; McGaw and Mitchell 1998; Mcllroy 1993; Rolls 1969). It certainly also helped that the pigs have no natural mammalian predators in the tropics (Choquenot et al. 1996; Mcllroy 1993; Tisdell 1982). Eventually, farmers started to describe pigs as a problem rather than as a food supplement and source of sport (G. Shuster, unpublished data). Pig management is a contentious issue. While international studies suggest that pigs cause significant environmental damage, the multiple stakeholders interested in their management have different perspectives on why and how this should be accomplished, and some question the validity of even managing pigs. The feral pig issue is an example of a larger environmental management concern.

The management of feral pigs is an example of intractable conflict in a socio-ecological system with multiple stakeholders and the added complexity of a highly mobile resource. Intractable conflicts represent long-term issues of contention that, despite efforts, fail to be readily resolved (Lewicki et al. 2003; Schon and Rein 1994). Socio-ecological systems are of themselves inherently complex. The presence of a resource in an ecosystem is not only influenced by ecosystem processes, but also by stakeholder use. The way particular stakeholder

groups value a resource and the interactions between these stakeholders impact resource use (Berkes and Folke 2000; Firey 1960; Gibson and Marks 1995; Marks 1984). Political institutions that fail to recognize the multiple interests of resource users may lose their legitimacy in the eyes of stakeholders whose needs are not met (Ostrom 1990; Steins and Edwards 1999). This may lead stakeholders to use resources according to their own personal guidelines and in direct conflict with legislation, resulting in the failure to meet policy goals. Meanwhile, policy that does consider the dynamic nature of a resource and stakeholder use of that resource may provide long-term management solutions (O'Brien 1987). My examination of feral pig management in FNQ would not only provide insight into this particular system, but also into the influence of socio-political relationships on the management of natural resources in general.

The site seemed perfect for my needs. There was an important local environmental issue whose challenges could provide information that was potentially relevant to the management of many types of natural resource issues. Also, AR is ideally perpetuated by the participants, and here was a crowd of farmers and other community members wanting to see management action in response to pigs that were damaging crops and causing harm to wildlife and protected habitats. But AR is not an easy approach to apply; in many ways it can be very challenging, in part due to the multiple stages and revision required by the process. For me, however, it was worth it. It allowed me to create a process that was as participatory as I was able to make it, and thus hopefully truly reflected stakeholder interests and values. The use of participatory methods in natural resource management is challenging and frustrating, but so important. Participatory programs that incorporate multiple user groups can help policymakers better understand stakeholder needs and gather the necessary information for creating more effective management

policy (Berkes and Folke 2000; Firey 1960; Gibson and Marks 1995; Holling 1973; Janssen 2011; Parson and Shils 1951).

My study began with a brief pilot project in 2007. I travelled to Mission Beach to check the feasibility of the study site. I interviewed a number of managers and scientists participating in the Terrain Integrated Feral Pig Management program and a handful of farmers and hunters introduced me to their concerns. This helped me understand the breadth of the issue and explore the habitat in which pig damage and management occurs. I commenced the formal study at the end of 2007. The first part of the AR process required planning meetings with both groups of stakeholders and individuals. We discussed study goals, logistics, recommendations for stakeholder participants, and methodology. I discussed methodology individually with members of the various stakeholder groups, in order to provide some control over the effects of group influences. I provided a handout with basic descriptions and examples of various available methods derived from a number of qualitative methodology texts (Bernard 2000, 2006; Booth et al. 1995; Greenwood and Levin 1998; Miles and Huberman 1994; Morgan 1997; Portelli 1998; Russell and Harshbarger 2003; Strauss and Corwin 1990).

Prior to sharing it, I acquired feedback on the handouts from a number of farmer and hunter stakeholders and made changes to the pages based on their advice. I reviewed the handouts about methods with farmers, hunters, and traditional land owners (TOs) in person or over the phone, provided examples of each method, and answered questions about these methods. For those participants who were unable or did not wish to read the handouts, I explained their content in person. I asked all the participants to suggest which methods they thought were best suited to achieving their desired outcomes and which methods they felt would be most compelling and thus might provide the most in-depth replies. I then asked them to

explain to me why they chose the particular methods in question. I also asked them if there were any other methods they thought might be useful and which I hadn't already suggested. Group meetings were also held to provide updates and receive feedback on the project.

My original proposed data collection methods were focus groups, semi-structured individual interviews, and participatory mapping. The final methods as proposed by participants were oral histories, semi-structured individual interviews, and a survey; the sociogram component was devised jointly between the stakeholders and I. I also originally planned to incorporate two paid research assistants; a young hunter and a grower to participate in conducting and analyzing interviews. It became apparent, however, that farmers and hunters wished to participate in the planning and feedback portions of the study rather than the on-ground data collection, which they did not necessarily have time to conduct due to other commitments.

Because this study used participatory methods, study participants were self-selecting. Initial participation was volunteered and participant references were provided during the introductory and planning meetings. The meetings with farmers were held at the local council building and in community halls. Farmers were also recruited during meetings with the Tully Canegrowers Association, the Tropical Exotic Fruit Association, and the Australian Banana Growers Council. Hunters were recruited during introductory and planning meetings held at my home in the form of informal barbeques, at the Tully and Kurrimine bow hunting club meetings, and with the assistance of the Sporting Shooters' Association of Australia in Queensland. Local newspaper advertisements and flyers were also used to recruit participants. In addition to formal meetings, informal recruitment also took place. People familiar with my study contacted me directly. I lived in my study area, so word of mouth recruitment occurred during daily

interactions. Also, participants were recruited while I conducted interviews and participant observation exercises.

These were all participants with an interest in pig management. The participants were all residents of the CCRC at the time of the study. Farmers and hunters were the impetus for this study. They already had pre-existing concern for pig management and wanted to see improvement in pig management strategies. TOs were recruited in a slightly different way. There is a strong TO presence in the region and yet they were glaringly absent from the pig management arena. There is only a brief mention of them in reports about a defunct community pig trapping program that once existed in the region. This led me to contact the Girringun Aboriginal Corporation to see if there was any interest in pig management. There apparently was an interest and so based on their recommendation and recommendations from other TO stakeholders, TO participants were included in the study, and they participated in providing feedback on study methods.

AR represents a kind of collaboration in action. While it is a research approach in itself, it also served as an arena for participant observation, where I could see how the values and beliefs expressed by stakeholders were translated into actions within the study framework. I offered participants the opportunity for participation they requested, and was able to see, within the bounds of the project and my ability as a researcher to coordinate this project, how participants chose to use this opportunity. These observations allowed me to explore how participation could be used as a potential tool for pig management programs in the region or for that matter, natural resource management in general.

The final research goals and questions were determined in conjunction with the farmers, hunters, and TOs who were the principal participants of the study. The purpose of this study was

to examine (a) stakeholder socio-political values and relationships and their impact on feral management, (b) how stakeholder socio-political relationships influence the use of pigs by other stakeholders, and (c) how these factors in turn influence the management of the feral pig socio-ecological system. Frame analysis played an important role in the organization and evaluation of the results. Frame analysis provides a context for the interactions between stakeholders. It describes the lenses stakeholders use to interpret new situations and events (Goffman 1974; Minsky 1975; Scheff 2005). I based my frames on the work of Gray (2003) who described nine frames that are relevant to the evaluation of intractable conflict.

The results of this study are presented in the following chapters as summarized here. Each chapter in this dissertation builds on the next. Chapter 2 examines stakeholders primarily at the individual level. It describes stakeholder perceptions and values regarding pigs and pig use. These values are described within the context of 'identity' and 'whole story' frames. The chapter presents the impact of these views on pig management as well as the merits of using frame analysis for the process of community engagement. Chapter 3 examines the socio-political relationships between stakeholders. This was interpreted with the assistance of 'characterization frames', 'power frames', 'social control frames' and 'identity threats'. This chapter describes the presence of two different social structures whose features are not clearly understood by the stakeholders themselves, yet which lead to conflict and misunderstanding between stakeholders. I also described the relevance of the social structures that function within a natural resource system to management processes.

Chapter 4 uses the elements of stakeholder values and relationships described in the previous chapters, and examines their influence on the feral pig socio-ecological system. Chapter 4 reflects on the influence of resilience theory on the practices of stakeholders. It utilizes

'conflict' frames to examine how stakeholders address issues of conflict. The chapter describes the inherent fragmentation in the use of the CCRC landscape for pig management by stakeholders. The chapter also shows that many farmer, hunter, and TO stakeholders follow ecological resilience practices in their use of feral pigs in the landscape, while managers tend to practice equilibrium resilience. The consequences of the poor communication between stakeholder groups, in combination with differences in resilience practices led to both conflict and poor management practice. I explore the relevance of these findings to the management of threatened protected areas. I also describe the importance of participation for defusing conflict and its relevance to this socio-ecological system and the management of threatened protected areas.

This study provided me with the opportunity not only to address the research questions at hand and to observe participation in practice; it taught me how to adapt the research methods and strategies in the light of this reflexive AR process, and provided practical examples of how the significance of participation changes and adapts during the research process. In 2009, I packed the last box of odds and ends—the invitation from the wedding I attended, the pig jaw bone a farmer gave me—into the car, made my farewells, pulled my compound bow off the wall, and left the CCRC area to organize my data and prepare for the next stage of feedback and analysis when I would return once more to CCRC to continue the action research process.

Literature Cited

Berkes, F., and C. Folke 2000. Linking Social and Ecological Systems. Cambridge University Press, Cambridge, UK.

Bernard, H. R. 2000. Social Research Methods: Qualitative And Quantitative Approaches. Sage Publications, Inc., Thousand Oaks, CA.

Bernard, H. R. 2006. Research Methods In Anthropology: Qualitative And Quantitative Approaches. AltaMira Press, NY, NY.

Booth, W. C., G. G. Colomb, and J. M. Williams 1995. The Craft Of Research. University of Chicago Press, Chicago, IL.

Choquenot, D., J. Mcllroy, and T. Korn. 1996. Managing Vertebrate Pests: Feral Pigs. . Bureau of Resource Sciences, Canberra, ACT.

Cornwall, A., and R. Jewkes. 1995. What is participatory research? Social Science and Medicine **41**:1667-1676.

Crome, F. H. J., and L. A. Moore. 1988. The southern cassowary in north Queensland- a pilot study. Queensland National Parks and Wildlife Service and the Australian National Parks and Wildlife Service, QLD.

Firey, W. I. 1960. Man, Mind and Land: A Theory Of Resource Use. Free Press, Glencoe, Il.

Gibson, C. C., and S. A. Marks. 1995. Transforming Rural Hunters into Conservationists: An Assessment of Community-Based Wildlife Management Programs in Africa. World Development **23**:941-957.

Goffman, E. 1974. Frame Analysis:An essay on the organization of experience. Harper, New York

Gray, B. 2003. Framing of Environmental Disputes. Pages 11-34 in R. Lewicki, B. Gray, and M. Elliot, editors. Making Sense of Intractable Environmental Conflicts: Concepts and Cases. Island Press, Washington, D.C.

Greenwood, D. J., and M. Levin 1998. Introduction to Action Research: Social Research for Social Change. Sage Publications, Inc., , Thousand Oaks, CA.

Herr, K., and G. L. Anderson 2005. The action research dissertation: A guide for students and faculty. Sage, Thousand Oaks, CA.

Holling, C. S. 1973. Resilience and stability of ecological systems. Annu Rev Ecol Syst **4**:1-23.

Hone, J. 1990. How many feral pigs in Australia? Australian Wildlife Research **17**:571-572.

Janssen, M. 2011. Resilience and adaptation in the governance of social-ecological systems. International Journal of the Commons **Vol 5**:340-345.

Lewicki, R., B. Gray, and M. Elliot, editors. 2003. Making Sense of Intractable Environmental Conflicts: Concepts and Cases. Island Press, Washington, D.C.

Marks, S. A. 1984. The Imperial Lion: Human Dimensions Of Wildlife Management In Central Africa. Westview Press, Boulder, Colorodo.

McGaw, C. C., and J. Mitchell. 1998. Feral Pigs (Sus scrofa) In Queensland in Department Of Natural Resources And Mines, editor. Pest Status Review Series-Land Protection, QLD.

Mcllroy, J. C. 1993. Feral pig Management In The Wet Tropics Of Queensland World Heritage Area. Final Report to the Wet Tropics Management Authority Cairns. CSIRO, Canberra, ACT.

Miles, M. B., and A. M. Huberman 1994. Qualitative Data Analysis: An Expanded Sourcebook. SAGE Publications, Inc Thousand Oaks, CA.

Minsky, M. 1975. A framework for representing knowledge. Pages 211–277 in McGraw-Hill, editor. The psychology of computer vision. Winston, P.H., New York.

Morgan, D. L. 1997. Focus Groups As Qualitative Research. Sage Publications, Inc., London.

O'Brien, P. H. 1987. Socio-economic and biological impact of the feral pig in New South Wales: An overview and alternative management plan. The Australian Rangeland Journal **9**:96 – 101.

Ostrom, E. 1990. Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press, Cambridge,MA.

Parson, T., and E. Shils 1951. Toward A General Theory Of Action. Harvard University Press, MA.

Portelli, A. 1998. What Makes Oral History Different. Pages 63-74 in R. Perks, and A. Thompson, editors. The Oral History Reader. Routlege, NY.

Pullar, E. M. 1953. The wild (Feral) pigs of Australia: their origin, distribution and economic importance. Memoirs of the National Museum **18**:7-23.

Rolls, E. C. 1969. They All Ran Wild. Angus and Robertson, Sydney, NSW.

Russell, D., and C. Harshbarger 2003. Groundwork For Community-Based Conservation: Strategies For Social Research. Altamira Press, , Walnut Creek, CA.

Scheff, T. J. 2005. The Structure of Context: Deciphering Frame Analysis. Sociological Theory **23**:368-385.

Schon, D. A., and M. Rein 1994. Frame Refelection. Basic Books, New York, NY.

Steins, N. A., and V. M. Edwards. 1999. Platforms for collective action in multiple-use common-pool resources. . Agriculture and Human Values **16**:241–255.

Strauss, A., and J. Corwin 1990. Basics Of Qualitative Research: Grounded Theory Procedures And Techniques. Sage Publications, Inc., Newbury Park, CA.

Tisdell, C. A. 1982. Wild Pigs: Environmental Pest or Economic Resource? . Pergamon Press Sydney.

Chapter 2

Re-Evaluating The Roles Of Stakeholders In Natural Resource Management: Frame Analysis And Feral Pigs

Introduction

The examination of socio-ecological systems provides managers a way to understand how people utilize natural resources (Berkes and Folke 2000; Young et al. 2006). Natural resources connect stakeholders with diverse beliefs and values and who use the same resources in very different ways (Berkes and Folke 2000; Buckles and Rusnak 1999; Hanna et al. 1996; Russell and Harshbarger 2003). Political institutions that fail to recognize the multiple interests of resource users may lose their legitimacy in the eyes of stakeholders whose needs are not met (Ostrom 1990, 2000; Steins and Edwards 1999). This can lead to continued use of the resource by stakeholders in habitual ways that ignore legislation and in turn policy goals will not be satisfied. Meanwhile, policy that does consider the dynamic nature of a resource, and is adapted to address stakeholder concerns, may provide long-term management solutions (O'Brien 1987). The challenges of managing socio-ecological systems can be compounded in the presence of a multiple use resource.

Multiple use resources are those that are used by individual or multiple user groups and for which a principle of subtractability exists (Steins and Edwards 1999). Subtractability occurs when the use of the resource by one individual or group reduces the potential for that resource to be used by other resource users (Ostrom 1990, 2000) . The combination of socio-ecological systems that contain multiple use resources can lead to intractable conflict. Feral pig management in Australia provides an example of just such a system; pigs are a resource whose management is subject to intractable conflict (Izac and O'Brien 1991; Katahira et al. 1993;

Tisdell 1982). An intractable conflict is hard to manage, complex, messy, intense, and frustrating. These types of conflicts represent long-term issues of contention that despite efforts fail to be readily resolved (Lewicki et al. 2003; Schon and Rein 1994). Internationally, feral pigs have diverse impacts on wildlife and plant ecology, economic, health and social sectors. For example, in New Zealand, local extinctions of the endangered Hutton's shearwater (*Puffinus huttoni*) were believed to be caused by feral pigs (Campbell and Long 2009; Cuthbert 2002). Pigs in Hawaii disperse strawberry guava (*Psidium cattleianum*) in the rainforests of the Kipahulu Valley in Maui effectively replacing native flora with exotic species (Diong 1982). Pigs have also caused significant economic damage to vineyards in the southwest of France where compensation provided to vineyards has increased from 110,125 to 463,340 euro in the past 19 years and pig populations are believed to be dramatically increasing (Calenge et al. 2004).

In Australia, there is a large and heterogeneous group of stakeholders interested in the management of pigs. For some stakeholders, pigs are considered a pest species to be eradicated due to the damage they can cause to agricultural lands and the biodiversity of the Australian landscape in general. To other stakeholders, while they may acknowledge that pigs can cause some damage to the landscape, the overall benefits afforded by this species in economic, cultural, and recreational value outweigh the ecological cost of this species. There is a substantial lack of clarity surrounding both the extent of pig damage and the policy used to determine management practices.

The quantification of the impact of pig damage can be difficult and costly (Johnson 2001). There are many examples of studies that evaluate pig damage including examples of soil erosion, plant destruction, and nest predation, but the long-term impacts of this damage to

ecosystems is unclear. For example, Hone (1998) found an inverse relationship between plant species richness in grassland areas and pig rooting behavior. He suggested that pig rooting that covered an area greater than approximately 25% of a grassland area could cause a rapid decline of species diversity, but the larger scale effects of this kind of damage remain unknown (Hone 1998). It has been found that pigs can carry the fungus *Phytophthora cinnamomi,* which can cause dieback in native vegetation and there is increasing evidence that they may be a vector in the spread of this disease, but the range and the degree of successful transference of the fungus is unclear (Johnson 2001; Kliejunas and Ko 1976; Masters 1979). Similarly, while a study by Richards et al. (1993) suggests that pigs consume and cause the destruction of habitat important to endangered frog species, it is unclear whether this has made a significant contribution to the decline of these species.

Damage reported on agricultural lands is primarily anecdotal. In the Tully region of North Queensland, farmers described the loss of as much as 20 bunches of bananas per month, at a cost between AUS$600 to $1800 in a year (Noble 1996). However, there has been no quantitative measure of this damage or its cost to the banana industry as a whole. Similarly, damage to tropical fruit has been regularly reported, but there are no quantitative measures of this damage (Johnson 2001; Noble 1996).

Feral pigs have become an increasingly important management issue in Australia. Today there may be as many as 23.5 million pigs inhabiting approximately half of Australia (Department of Sustainability 2011). While considerable legislation has been developed regarding the management of pigs, these policies tends to be decidedly vague and lacking in clarity. Individual states and territories are required to designate their own pig legislation. Pigs are a declared pest and within six of the eight states and territories, legislation requires the

control or eradication of pigs by landowners. The two that do not have pig management policy are the island state of Tasmania which has pigs only on one off shore island, and the Australian Capital Territory whose Department of Territories does recognize pigs as a pest, but has no formal policy for their management (Izac and O'Brien 1991; Office of the Queensland Parliamentary Counsel 2011). A study by Izac and O'Brien (1991) reviewed Australian pig management legislation and demonstrates the lack of clarity and the large variability of pig management policies in this literature. For example, while pigs have been declared a pest, this term has a different legal status in different states and the meaning has been regularly changed over time. Additionally, there are no clear federal and state guidelines for their control.

This study evaluates the example of feral pig management in the Cassowary Coast Regional Council of Far North QLD. The Wet Tropics of Far North Queensland is estimated to hold as much as 75% of Queensland pig populations partly because their need for a regular source of water and habitat cover are easily met (McGaw and Mitchell 1998). The purpose of this paper is to examine stakeholder values and beliefs through the use of frame analysis in order to begin to discover the sources of conflict that occur in the management of pigs. The positions of hunters, farmers, traditional owners and managers are evaluated. This study uses frame analysis to explore the conflict drivers described by stakeholder values in natural resource management. Few studies of feral pig management examine in detail the perceptions of these stakeholders, despite their central role and connection to pig use (Bauer and Giles 2002; Sharp and Wollscheid 2009; Zivin et al. 2000).This study uses Gray's method for frame analysis of environmental disputes (Gray 2003). Frame analysis can provide an arena in which to evaluate the components of complex environmental management issues. Through this examination, it may

be possible to then reframe contentious issues in order to encourage more positive management outcomes.

Literature Review

Intractable Conflict

The management of feral pigs can be defined as an intractable conflict. In the realm of natural resources, intractable conflict can be found, for example, in wildlife management such as the long-term challenges of regulating harbor seal populations in Moray Firth in northeast Scotland. Three main stakeholder groups are at odds about the management of the seals. Salmon fishers contend that seals have a significant negative economic impact on salmon fishing activities and so legally shoot seals (Butler 2011; Thompson PM 2007; Young et al. 2012). Meanwhile wildlife tourism operators and conservation groups feel culling of the seals endangers these populations and interferes with the general interests of the operators and conservation groups. These two groups continue to be at odds. Butler (2011) contends that the conflict arises in part from the top down structure of management actions in which key stakeholders, such as the fishers, are not incorporated into management practices.

In Cochabamba, Bolivia the management of the city water supplies is exemplified by poor management practice and corruption. Water rights were eventually privatized without warning and residents experienced water rates hikes representing as much as a quarter of their income or more. Residents responded with mass protests that ended in violence. The conflict eased only after the water system was reverted back into public control (Postel and Wolf 2001). In order to begin to understand the nature of the feral pig management conflict, it is necessary to understand something about the nature of this type of resource.

Pigs As A Common Pool Resource And Frame Analysis

Feral pigs represent a common pool resource. A common pool resource is a multiple use resource that is of a considerably large size so that it is too costly or difficult to restrict access to beneficiaries (Dietz et al. 2003; Ostrom 1990, 1999). Feral pigs fit the description of a multiple use resource in part because the use of pigs is intimately tied to the land on which they exist and if one stakeholder group lays claim to pigs in a particular area, another stakeholder is excluded from its use. Zivin (2000) focuses on the economic gains or recreational gains from pig use as being mutually exclusive. He describes the land on which the pig itself exists as the multiple use resource with the landowner gaining exclusive economic or recreational benefits from trapping and/or selling pigs captured on his land. Based on this principle, he created a model to describe landowner options for the use of pigs on their properties.

Hardin (1968) suggests that any time there is such a thing as a common pool resource, the drive for individuals to act for their own benefit will, unchecked, ultimately destroy the resource in question. According to Hardin, this process can be sustainable when populations are limited, but when populations are large, this scenario leads to a "tragedy of the commons" situation. Hardin's model, however, assumes that each stakeholder works in a vacuum; that s/he is completely unaware of, and acts completely independently of, the actions and attitudes of all other stakeholders. This model also assumes that cultural norms do not influence the decision-making process. When these assumptions are met, Hardin's model may very well be accurate. For example, this model is accurate when stakeholder behavior goes unnoticed (neither penalized nor rewarded) or when communication systems breakdown (Cardenas and Ostrom 2004; Dietz et al. 2003; Ostrom 2000).

Ostrom (1990) uses game theory to show that resources systems do not always behave in this manner. She used game theory, experimentation, and comparison to field studies of socio-ecological systems to demonstrate that when communication is allowed between stakeholders, resources can be removed from the resource system at an ideal rate that prevents the destruction of the resource (Ostrom 2000; Steins and Edwards 1999). The theory of communicative action describes communication as being essential for the success of formal institutions (Habermas 1984, 1987; Helmke and Levitsky 2004; Rydin 2003). Ostrom (1998, 1999, 2000) describes communication as essential for successful management of common pool resources. Language is a complex structure. Habermas (1987) describes language as consisting of 'speech acts'. Speech serves to maintain and establish interpersonal relationships, to represent "events and states" and represent one's own self (Habermas 1987; Rydin 2003). Therefore, for successful management interactions, it is not just the presence of communication that is needed; it is also essential to have the ability to understand the intention of the language used (Habermas 1987; Rydin 2003).

Resource systems are not spontaneously forming entities that are a product of the environment; rather, they are a social construct. They are the product of community consideration, public choice, and agreement (McCay 1996). In order to appropriately manage a resource, it is thus necessary to create management practices that consider local stakeholder values, concerns, and knowledge and occur in a realm that includes a functional communication network. In this way, management strategies can be created from a more complete knowledge base in which there is accurate knowledge both about the resource and resource users. It requires the partnership of biological, economic, and socio-political aspects of management (McCay 1996; Ostrom 1998, 1999). Discourse theory is one of the methods widely used to examine the communication that occurs between stakeholders. Discourse is about the creation of knowledge

through language and practice. It defines the way a subject is evaluated and discussed (Foucault 1972, 1980; Hall 1997). There are multiple discourse strategies that can be applied to the analysis of common pool resource systems. Framing analysis is one such type of discourse strategy (Rydin 2003; Schon and Rein 1994). The essential purpose of frame analysis is to describe the context for the discourse occurring between stakeholders. Frame analysis examines the attributes of the lenses through which stakeholders perceive and then interpret new events or scenarios with which they are confronted (Goffman 1974; Minsky 1975; Scheff 2005).

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There has been much critical debate surrounding frame analysis; much of the criticism is centered on the lack of a clear operational definition of the terms frame and framing (for a review see (D'Angelo 2002; Entman 1993; Scheff 2005). Dewulf et al. (2009) most recently addressed this debate by arguing that rather than one uniform method to define and investigate frames or framing, a multiple paradigm approach is most beneficial. The authors describe two different frame analysis paradigms: interactional and cognitive. The interactional paradigm focuses on analyzing the framing process (Bateson 1972; Benford and Snow 2000). Frames are

transient entities that continually change; the information that feeds frames grows and changes in every interaction between stakeholders (Dewulf et al. 2009). Unlike the interactional paradigm, the cognitive paradigm examines and defines particular frames at a particular moment in time rather than examining how the framing process occurs and changes. The objective of the cognitive paradigm is to examine the frames themselves (Dewulf et al. 2009; Oliver and Johnston 2005).

This study applies the cognitive paradigm to examine feral pig management. The basis of the cognitive frame is rooted in the work of Minsky (1975), who defined a frame as a "data structure for representing a …situation." He described the foundation of frames as being in the memory; a frame behaves as a "remembered framework to be adapted to fit reality by changing details as necessary." People draw upon these frames when presented with a new event or scenario. While a frame can be considered relatively constant over some period of time, it can change; frames change as individuals change (Dewulf et al. 2009; Scheff 2005). The frames are fed by both internal and external influences, and they are developed with both conscious and subconscious input (Benford and Snow 2000; Benford and Snow 2005; Dewulf et al. 2009; Johnston and Lio 1998; Johnston and Oliver 2005; Matthes 2009; Oliver and Johnston 2005; Scheff 2005). Stakeholders apply multiple frames to every scenario, which Minsky (1975) refers to as 'frame systems'. The beauty of frame analysis is that it can be used not only to examine intractable conflicts, but also to determine arenas in which to reframe conflict in order to begin to develop management solutions. Reframing is the process of reinterpreting issues or reappraising other stakeholders or their values in the conflict. The purpose of reframing is to help facilitate the process of moving from conflict to collaboration. Reframing does not always guarantee the

resolution of conflict, but it does offer the capacity to facilitate or defuse some aspects (Lewicki et al. 2003; Schon and Rein 1994; Shriver and Peaden 2009).

This study examines some of the features that make feral pig management in the CCRC of Far North QLD an intractable conflict. In this study I employ two types of frames in order to describe socio-political relationships: identity and whole story frames. Identity frames describe how a stakeholder perceives themselves, in this case, in relation to the socio-ecological system of feral pig management. Whole story frames are a stakeholder's basic perception of the management issue (Lewicki et al. 2003). Identity and whole story frames represent the fundamental building blocks for understanding the relationships between stakeholders and the way resources are used. They reflect the beliefs, values, and attitudes that are foundational components for understanding how stakeholders act. By understanding these aspects of stakeholder character we can begin to understand both sources of conflict and methods for resolving them. For example, one cause of intractable conflict is the result of 'identity threats'. Identity threats occur when the legitimacy of a person's identity is called into question (Kelman 1999; Rothman 1997). People become defensive and refuse to compromise because compromise could call into question their ethical values and sense of self (Goffman 1959; Gray 2003; Parson and Shils 1951). Stakeholders may also externalize the responsibility for negative circumstances onto others who have identities in opposition of their own (Gray 2003).

All people have deeply held beliefs and values, but they do not necessarily always act on these beliefs and values (Gardner and Stern 2002a; Goffman 1959). Whole story frames direct stakeholder behavior in negotiating conflict (Campbell and Docherty 2004). If stakeholders do not act in accordance with their identity or whole story frames, an understanding of these frames can provide an explanation for why this occurs or else how actions may be modified based on the

nature of these frames in order to reduce conflict (Campbell and Docherty 2004; Gardner and Stern 2002a; Rydin 2003). Knowledge of these frames can also help promote transparency and better communication among stakeholders. Both components are important features for successful participatory management practice and conflict resolution (Cornwall and Jewkes 1995; Greenwood and Levin 1998; Habermas 1987; Kant and Cooke 1999; Ostrom 1999). The cause of conflict is sometimes simply the result of misunderstanding of fundamental stakeholder characteristics (see Chapter 4).

Conflict Drivers

While intractable conflicts are defined by their long-term nature, messiness, complexity, and polarization, the underlying causes of conflict differ between conflicts. Typologies of conflict allow the evaluation of these conflict drivers. Identity and whole story frames describe the positions of stakeholders in regards to a conflict, but a typology can be used to analyze what elements of these frames contribute to conflict (Lewicki et al. 2003; Rydin 2003; Schon and Rein 1994). There are many typologies of conflict (Bennett et al. 2001; Furlong 2005; Moore 1996; Ramirez 1999; Robbins 2004). This study will use Christopher Moore's typology which incorporates key principles found in other conflict typologies (Furlong 2005; Moore 1996).

The underlying drivers for conflict as described by Moore (1996) are: value, data, structural, interest, and relationship conflicts. Values incorporate stakeholder values, beliefs, ideologies and goals. Data refers to poor quality information or mismanagement of information, divergent data interpretation and application. Interests refer to psychological and procedural interests and the competition between truth and interests. Structural conflict regards geographical, physical, or environmental factors that create barriers to cooperation such as time restrictions, power issues and destructive behaviors. Relationships refer to emotional

interactions, stereotypes, communication issues, and negative behaviors. This study evaluated the drivers found within identity and whole story frames. It is beyond the scope of this study to examine in detail socio-political relationship. For this reason the relationship conflict driver will not be examined in this chapter as it is relevant to the examination of socio-political relationships rather than individual stakeholder group identity and whole story frames. For an analysis of the content of the relationship driver refer to Chapters 3 and 4.

Research Setting

Pig Legislation And Management In QLD

Pig management in Australia certainly fits the intractability criteria of being a long-term and intense conflict. Feral pigs were introduced to Australia as a food source during European settlement in the early to mid-nineteenth century (Choquenot et al. 1996; Department of Sustainability 2011; McGaw and Mitchell 1998). Pig management has been a concern in QLD since 1930 when the first regulation was passed declaring feral pigs a pest and requiring their management in one district of QLD. Feral pig regulations were officially adopted state-wide in 1973 (Izac and O'Brien 1991). The original policies required pig control, but as pig populations grew, policy also evolved. Current pig regulations require stakeholders to not only control pigs on their properties, but to take 'reasonable' actions to keep their properties 'pest-free' (Office of the Queensland Parliamentary Counsel 2011). Federal policy also incorporates pig management legislation. The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) describes the "predation, habitat degradation, competition and disease transmission by feral pigs" as a "threatening process". In conjunction with states and territories, a deliberately vague management plan was created basically requiring: 1) prevention of the spread

of pigs to areas where they do not occur, 2) integration and implementation of pig management plans at all political levels, 3) quantification of pig damage, 4) awareness programs about pigs and damage, and 5) development of management tools to the most humane standards (Department of Sustainability 2011).

There have been numerous management schemes enacted in Queensland to control pigs. All these programs have ultimately broken down. For example, a bounty paid for pigs culled was first introduced in 1870 and received state government backing in 1945 (Choquenot et al. 1996). Growers, graziers, and hunters participated and the bounty served to provide extra income and help compensate for the cost of pig management. It also served to encourage pig control actions, provide some information about pig populations and movement, and appeared to have had some impact on pig populations (Laun 1971; Smith 1990; Tomlinson 1957). The bounty, however, was phased out in 1975 because of the failure of the system. The failure was in the form of fraud, for example, pig scalps used as proof of culling were transferred from regions with lower bounties to those with higher bounties or pigs were deliberately bred and released for the sake of collecting bounties. There were also the suggestions that ultimately pig numbers might not be decreasing, and as pig bounties increased, they eventually were considered to exceed the value of pig damage (Choquenot et al. 1996; Hassall and Associates Pty Ltd. 1996; Laun 1971; Rolls 1969).

This bounty program was followed by multiple contract trapping programs primarily through the Queensland Parks and Wildlife Service (QPWS) division, followed by the Community Based Feral Pig Trapping Program which ran between 1993 and 2002. This last program was long running and used local trappers supervised by DPI managers to assist with pig management. It was successful at trapping pigs and increased interaction between stakeholders. Program failure according to program coordinators was due to poor access to some lands, high

labor costs, lack of resources, inability to manage defuse resources, lack of sufficient program monitoring, and general management failure (Hillier 2002). It has also been described by some stakeholders as suffering from poor community integration and general lack of funding and fund mismanagement (G. Shuster, unpublished data). This was eventually replaced by the contract pig program developed by Terrain Natural Resource Management and using Boar Busters as a contract trapper. Feral pig management is a source of conflict not just because of its long-term nature. One of the sources of intractability arises from the interaction of the multiple stakeholders concerned with management. It is useful then to understand the background of the local stakeholders involved in feral pig management in FNQ.

Stakeholders In Pig Management

There are a number of stakeholders that are affected by pig management legislation in QLD. In the Cassowary Coast Regional Council, these groups include farmers, hunters and traditional land owners, and managers. In order to understand stakeholder positions, it is necessary to first understand something about the background of these groups.

Farmers

This group of stakeholders identified themselves as ‘farmer’ or ‘grazier’. The farmer stakeholders I interviewed all grew one or more crops. The ‘grazier’ participant raised cattle and also has some crops. In order to describe this segment of stakeholders, I will provide general background about the role of agriculture in the CCRC.

The Wet Tropics of Far North Queensland is a region of rich agricultural land. In CCRC, agriculture, forestry, and fishing are the primary industries (Office of Economic and Statistical Research 2012). According to the most recent census information, crop production represents 98% of agricultural income and this sector of the industry is worth AUS$592 million (CCRC

2011, 2012a; Office of Economic and Statistical Research 2012), which is 10.9% value of all crops raised in QLD (Office of Economic and Statistical Research 2012). The region is home to about 80% of Australia's banana industry. The most recent economic figures show that in 2008, the banana industry produced a revenue of about AUS$388 million in 2009; approximately AUS$157 million of sugar revenue, and based on available information, the tropical fruit industry earned more than AUS$18 million (Canegrowers 2010; CCRC 2011, 2012a; Fisheries 2012). The cattle industry accounts for AUS$10.3 million.

Hunters

In Australia, because pigs are not a protected species, anyone can hunt them outside of national parks and reserves (Takahashi and Tisdell 1989). Most hunters collect pigs using shot guns, but dogs and bows are also sometimes used. Additionally, pigs can be sought using night spotlight hunting (Roberts et al. 1999). Feral pigs may be hunted all year, although there is often a seasonal influence on hunting activities. As in other parts of the world, pigs are hunted for recreation, food, and as a source of income. There were an estimated 900,000 hunters or 5% of Australians that hunted in 1996 (Bauer and Giles 2002; Brown 1997).

Hunters collect pigs not for the primary purpose of consumption or sale, but for entertainment. There are, however, many recreational hunters who consider themselves to be important to the management of pig populations (Tisdell 1982). Mason and Fleming (1999) found that during informal discussions, these hunters, like indigenous hunters, preferred that the feral species not be eradicated completely. Meanwhile, commercial hunters may hunt specifically for the purpose of selling pig meat for local or international sale. Hunting is an important way of building social capital and prestige. It shows the individual to be skilled and capable and hunting activities help to build, strengthen, and sustain the relationships between

participants. The implications have relevance beyond the hunting arena and in everyday events of the community (MacGaffey 1991; Tisdell 1982). Hunting activities bring a profit of more than 1 billion dollars each year with and approximately $325 million of this distributed in rural areas. This expenditure is allocated to such things as vehicles, hunting weapons and ammunition, gas, magazines, video equipment, and hunting fees (Bauer and Giles 2002). There is little information on the perceived status of hunters in Australia. Bauer and Giles (2002) posit that hunters have a negative image according to public opinion both in urban areas and among professionals.

Traditional Land Owners

It is important to at least briefly describe the traditional land owner (TO) history of the region, because this history has a significant impact on participant identity. Prior to Western contact, TO groups lived in particular territories. They did not 'own' these territories or what is referred to now as their 'country'; rather they were part of that landscape and were its care takers. They lived a subsistence lifestyle, building semi-permanent huts and traveling the landscape seasonally in conjunction with seasonal availability of food resources. TO cultures are rich in arts and ritual and their histories were based on the landscape that was integral to their belief system (Collins et al. 1996; Lockwood 1963; Simmons 1993). When FNQ was first colonized, there was much turmoil between TOs and the immigrants. Battles occurred over land as TO country was usurped by migrants. The culmination of this conflict resulted in the formation of the Hull River Aboriginal Settlement in 1914 at what is now known as South Mission Beach (Pedley 2003; Pentecost 2007). It was never a formal Mission, but for four years until 1918, TOs from the region were imprisoned there and used as laborers. A cyclone in 1918 destroyed much of the settlement and left the colonists to advance their plans to create a new settlement at Palm Island off the coast of Townsville (Martin 2011; Pentecost 2007). The

proposed purpose of Palm Island was to encourage 'assimilation' to Western culture, and although some came willingly to stay close to family, most did not arrive by choice. This resulted, for some, in the loss of ancestral history and sense of country (Martin 2011; Watson 1993).

The parents of four of the five participants in my study as well some of their extended family spent some amount of time living on Palm Island. One of the study participants was born on the island. TO residents of the island returned to the mainland as soon as it became possible. Many dispersed to other regions due to the loss of cultural identity, the physical loss of their home countries to colonists, or the destruction of their settlements. Others returned to the regions that had been their homes and joined remaining members of their families or community or else returned to reclaim what they could. The ownership of Palm Island was finally handed over to it's TO residents in 1986 (Hyams et al. 2007; Simmons 1993; Watson 1993).

The region of CCRC is home to traditional owners from six TO groups: Djiru, Girramay, Gulgnay Jirrbal, Ma: Mu, and Banjin (Horsfell 1984; Pentecost 2007; Simmons 1993). The indigenous population represents approximately 8.3% of the residents of CCRC (Office of Economic and Statistical Research 2012). Four of these groups, Djiru, Girramay, Gulgnay, Jirrbal, and Banjin along with three other TO groups located to the south and west of CCRC, are members of the Girringun Aboriginal Corporation. Girringun plays numerous roles in the region, but one of its major objectives is to participate in environmental management. In particular, the Great Barrier Reef Marine Parks Authority (GBRMPA), a government organization that manages the care of the World Heritage listed Great Barrier Reef Marine Park, grants Girringun the rights to contribute to the management of the park (Girringun Aboriginal Corporation 2012). However, they have no involvement with any pig management programs.

There is limited published information on the relationship of traditional owners to feral pigs. Roberts et al. (1999) noted the work of Bruce Rose, who found that an aboriginal community in Alice Springs had accepted feral pigs as part of the local resource system and thus the pigs also became a part of the spiritual beliefs of the area. There are even local norms in some areas in Cape York that prevent the hunting of pigs without special permission (Roberts et al. 1999). Roberts et al. suggest that indigenous hunters are generally not recreational hunters. Pigs are most sought after during the turtle laying season and in the dry season when pigs become fat from consuming turtle eggs and consumption of dry grasses turns their fat yellow (Roberts et al. 1996). Adult pigs are often taken opportunistically by indigenous hunters during transit and hunting of other species (Bomford and Caughley 1996). In FNQ, at the time that a government subsidized pig management program was running, the Community Based Feral Pig Trapping Program, several TO groups were asked if they would like to participate in the project. According to the participating officials, they did not show an interest in participating in the project (Noble 1996; see also Chapter 1).

Managers

As of 2010, the total park and forest estate of CCRC, which includes all national parks, state forests, timber, and forest reserves in the Local Government Area (LGA), is approximately 2,844 km^2. This represents 2.4% of the total protected area in Queensland. In comparison, the agricultural lands in the CCRC area are roughly 2,030 km^2 (CCRC 2011; Office of Economic and Statistical Research 2012).

The label of ‘managers’ is used here to represent land management organizations that have some connection to the management of public or private lands. This heading incorporates a diverse group of organizations and stakeholders that hunters and farmers consider relevant to pig

management. There are two main sub-categories of managers under this heading that I will refer to as ‘environmental’ and ‘agricultural’.

Environmental managers work for public or non-profit organizations concerned with the management of public lands. They include Wet Tropics Management Authority (WETMA), Department of Primary Industries and Fisheries (DPIF), Terrain Natural Resource Management (Terrain), Queensland Parks and Wildlife Service (QPWS), and Communities for Cassowary and Coastal Conservation (C4). I also included a CCRC council representative (CCRC Rep) because this stakeholder is a land manager responsible for on-ground management of council lands. The organizations WETMA, DPIF, Terrain, C4, and Queensland Parks and Wildlife Service (QPWS) focus on the management of public lands. WETMA is the direct Queensland manager for the Federal Minister of the Environment. They administer federal funds and make initial management decisions regarding the care of the Wet tropics of Queensland, and they promote research, cooperative management and education programs about the tropics (WETMA 2010). DPIF provides policy information and conducts research to assist in improvement and maintenance of primary industries –agriculture, livestock, forestry, fisheries, and biosecurity (Clark 2010). DPIF promotes sustainable practices, but also aims to support economic growth and to provide industry support. Terrain is a non-profit organization that participates in natural resource management (NRM) in the Wet Tropics. They have an interest in working with community partners who use these resources. They provide management assistance and support for anyone interested in NRM. Terrain is used as a platform for government associations to connect with local community interests (Mar 2009).

C4 is a community run non-profit organization that is concerned with environmental management and information sharing with the public. Their focus is particularly on education,

habitat and wildlife protection and rehabilitation (C4 2012). QPWS is part of the Department of Environment and Resource Management and is responsible for on-ground management of Queensland national parks. In particular QPWS is dedicated to protecting wildlife and native vegetation, providing facilities for visitors, and helping visitors to understand conservation objectives (DERM 2010). CCRC is responsible for maintenance and management of basic community services and infrastructures, but in addition to these responsibilities CCRC is responsible for the management of all public lands outside of national parks (CCRC 2011).

Agricultural managers are part of both for-profit and non-profit organizations with interests in the agricultural sector. They include the Tully Sugar Mill (Tully Sugar, Ltd), Tully Cane Productivity Services Limited (CPS), and Canegrowers Australia (CGA). As mentioned earlier, the cane industry is one of the major agricultural activities of CCRC. Tully Sugar produces an average of 260,000 tonnes of raw sugar per year and an average of about 50,000 tons of molasses each year. The cane is processed between June and November each year (Tully Sugar Ltd. 2012). Tully Sugar is a public company whose primary investors are farmers (Tully Sugar Ltd. 2012). CPS is jointly controlled by Tully Sugar and local farmers, and also works in partnership with BSES Limited, a research institution that conducts cane research and is jointly owned by the Mill and farmers. The primary role of CPS is to provide assistance with and research in pest and disease management. In addition, CPS administers the new varieties of cane developed by BSES to the farmers (BSES Ltd. 2012; CPS 2009). CGA is a Queensland based organization with a local branch in CCRC. It is owned and operated by cane farmers. CGA assists with cane management, provides insurance, facilitates communication between farmers, acts as negotiator with the mill and as a government lobby for cane growers, and disseminates

information about the latest innovations in the cane industry (Canegrowers Australia 2010; Tully Sugar Ltd. 2012).

Others

The Cassowary Coast Regional Council (CCRC) represents an amalgamation of the former Cardwell and Johnstone shires with council lands that cover 4,702 square km. It consists of six elected divisional councilors and a mayor that is popularly elected (CCRC 2012b). The State of Queensland government parliament consists of only one house called the legislative assembly. The 89 members of this parliament represent each state electorate district (Queensland Parliament 2011).

Tourism is an important industry in the CCRC area. It contributes approximately AUS$100 million per annum to the income of CCRC (CCRC 2012c). The tourism industry primarily subsists on the local resources of national parks, Great Barrier Reef, the iconic endangered cassowary, and adventure tourism such as white water rafting, scuba diving, and sky-diving (CCRC 2012c; G. Shuster, unpublished data).

The vet interviewed for this study described that in the CCRC there is a partnership of four veterinarians that run various clinics. In addition, he described one additional vet working in the town of Innisfail, at the northern extent of the CCRC area. The vets all deal with pets, livestock and some deal with wildlife. Some, but not all the vets, also care for pig dogs.

Methods

To study some of the features that make feral pig management in the CCRC of Far North QLD an intractable conflict, and to understand the relevant socio-political relationships in this conflict using frame analysis, I employed an action research approach. This study represents part

of a larger action research (AR) study that began in 2007 (Chapter 1). I worked together with other relevant stakeholders to develop research questions, design and carry out the study, and disseminate information. This form of research requires constant evaluation, feedback and cycles of reflection to help assure that the principles of AR are maintained and has a practical action as a result (Greenwood and Levin 1998; Herr and Anderson 2005; Portelli 1998; Russell and Harshbarger 2003). The study was designed in conjunction with hunters, growers and had some input from traditional land owners (TOs). The study goals, data collection methods, interview guides, and participants were selected with the assistance of hunters and farmers. TOs assisted with participant selection, but were incorporated into the study later; three of the five TOs were incorporated into the study early enough to have some input into the data collection methods. All TOs were asked for feedback about the study goals, data collection methods, and interview guide regardless of when they joined the study. Data were collected using oral history and individual interviews, participant observation, and sociograms. Data analyses were based on a grounded theory approach and themes derived from the grounded theory processes were further evaluated using a cognitive paradigm of frame analysis.

The study was conducted in the Cassowary Coast Regional Council (CCRC) area in the Wet Tropics of Northern Queensland between 2007 and 2009. The CCRC area covers 4,700 km^2. The limits of this region include the town of Garradunga to the north, Cardwell to the south, East Palmerston to the west and the most eastern boundary is not marked by a particular town, but more by a complex of islands and reefs that make up part of the Great Barrier Reef Marine Park (Figure 1). The region consists of approximately 31,291 persons over a region of 4,700 km^2. The official language is English, but there are a number of indigenous dialects spoken and

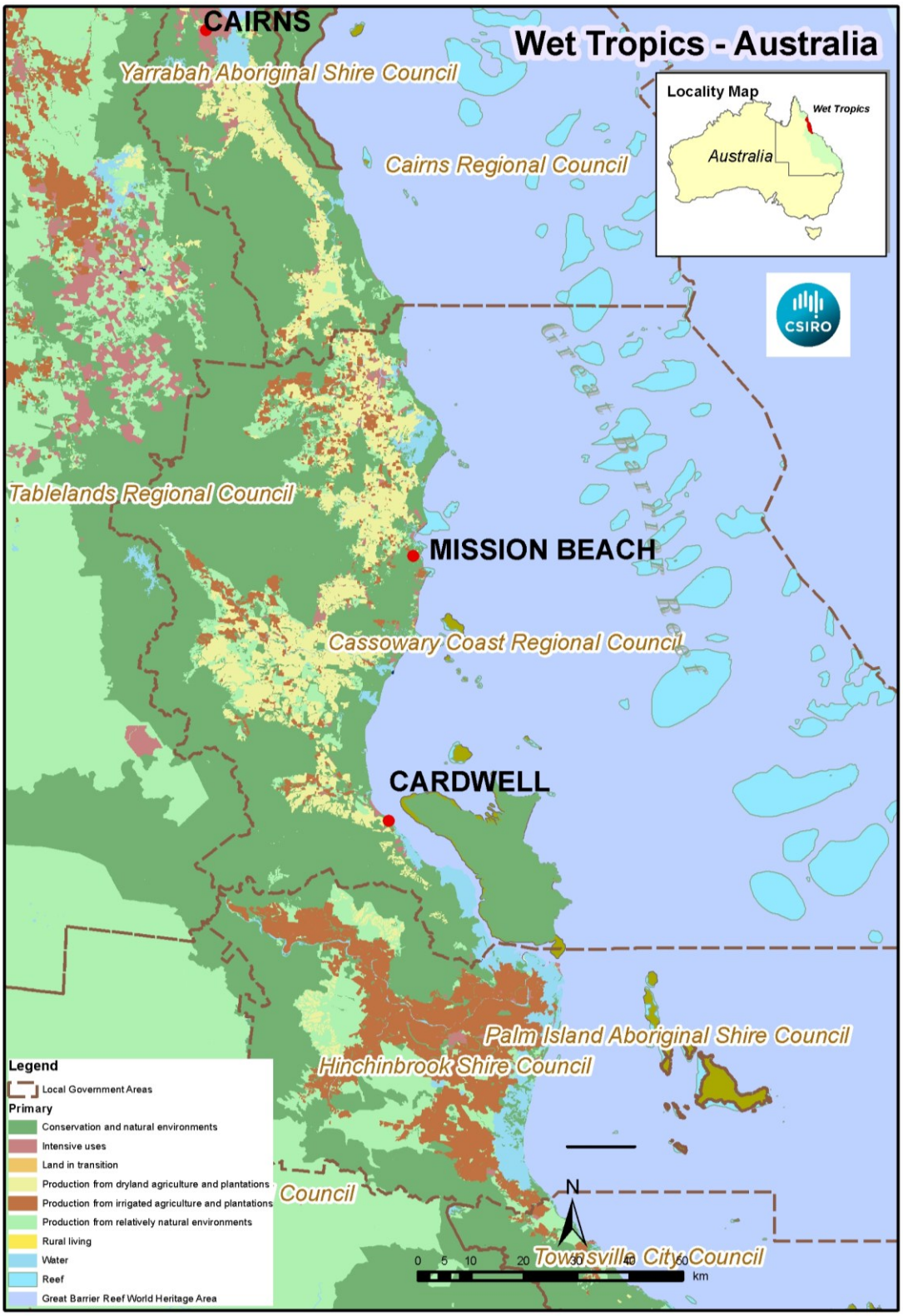

Figure 1. CCRC area including political boundaries and land use. This map was provided courtesy of CSIRO (Pert 2012).

because there is a significant migrant history, a total of 48 languages are used in the region (CCRC 2011; Girringun Aboriginal Corporation 2012; Henzell 2007; Simmons 1993).

A total of 52 collaborators were interviewed for this study (Table 1). Oral histories were conducted with the principle collaborators: the 15 hunters and 15 farmers. In addition, I observed that TOs, a key group, were missing. Thus, oral histories were also conducted with individual representatives of each of 4 mainland TO groups of the CCRC area: Djiru, Girramay, Jirrbal, and Ma:Mu. An additional TO was interviewed who was unable to identify his TO ancestry. Individual interviews were conducted with the remaining 17 participants. These participants were referred to me by the two principal collaborator groups. This last category of participants is referred to simply as 'managers,' included several types of environmental and agricultural managers, government, and commercial representatives (Table 1). Environmental managers work for public and non-profit organizations concerned with the management of public lands. I also included a CCRC council representative (CCRC Rep) because this stakeholder is a land manager responsible for on-ground management of council lands. Agricultural managers are part of both for-profit and non-profit organizations with interests in the agricultural sector. There is, additionally, one state government representative, one other CCRC representative and the commercial representative is a local contractor.

Data collected in the form of participant observation included informal feedback from multiple other CCRC residents. The Tully Bow Hunters Club, the Kurrimine Bow Hunters Club, and the Queensland branch of the Sporting Shooters' Association of Australia assisted with this study. Staff from the Commonwealth Scientific and Industrial Research Organization (CSIRO) and Terrain Natural Resource Management, who sponsored the study and contracts Boar Busters, also participated.

Table 2. Description of the collaborators who participated in the interview process. This table includes information about the interview types used, collaborator identity, type and the number of participants in the study.

Interview Type	Identity	Type	Number of Participants
Oral History	**Farmer**	Cane	5
		Banana	5
		Tropical Fruit	3
		Grazier	1
		Plantation	1
		Total	15
	Hunter	Bow Hunter	5
		Pig Dogger	5
		Rifle Hunter	3
		Prof Trapper	1
		Prof Chiller Box Hunter	1
		Total	15
	Traditional Owners	Djiru	1
		Girramay	1
		Jirrbal	1
		Ma:Mu	1
		Other	1
		Total	5
Individual Interviews	**Managers-Environmental**	Wet Tropics Management Authority	1
		Department of Primary Industries and Fisheries	1
		Terrain Natural Resource Management	2
		Queensland Parks and Wildlife Service	4
		Communities for Cassowary and Coastal Conservation	2
		CCRC Council Representative	1
	Agricultural	Tully Cane Productivity Services, Ltd	1
		Canegrowers Australia	1
		Tully Sugar Mill (Tully Sugar, Ltd)	1
		Total	14
		State Government Representative and CCRC Council Representative 2	2
	Commercial	Boar Busters	1
		Total	3

Data Collection

Planning and Group Meetings

Planning meetings were held separately with farmers and hunters at the beginning of the study to organize the research process. Planning meetings were later held with TOs. Group meetings were held with these stakeholders throughout the research process in order to reflect upon and revise the research process.

Oral History

Participants suggested that I use oral histories as the principal interview method. Oral histories are a kind of individual interview that provides one person's viewpoint of events (Portelli 1998). The interviewee is the main speaker who leads the description of events, people, places, and stories. The interviewee in an oral history is sometimes referred to as a narrator for this reason. The role of the interviewer is to help guide the interview. The interviewer helps to keep the interview from straying off the topic. He or she helps ask questions to probe, explore and clarify the depths of the story being unraveled (Sommer and Quinlan 2002).

The type of oral histories recorded here are single issue interviews. These histories provide detailed information and insight into one particular subject (Douglas et al. 1988). I used single issue interviews to review a participant's history in relation to pigs. This method was used to interview all hunter, farmer and TO participants. I held one or two sessions with each participant over a maximum of about 2 hours. Collaborating hunters, farmers, TOs and I created an interview guide to direct these interviews (Appendix 1). The purpose of the guide is to act as a flexible plan for the interview; it includes important topics, but specific questions and the exact phrasing may change depending on the direction taken by the narrator (Yow 1994). Answers to

these questions might be provided by the narrator without prompting while he presents his narrative about pig management.

Individual Interviews

I also conducted individual interviews which hunters, farmers, and TOs considered important to feral pig management. Interviews were presented in a semi-structured format (Bernard 2000, 2006; Booth et al. 1995; Morgan 1997). These interviews, unlike oral histories, are interviewer led and address specific topics included in the format, though some flexibility remains in the direction and ways these topics are addressed *(*Bernard 2000, 2006*)*. Collaborating hunters, farmers, TOs and I created an interview guide to direct these interviews (Appendix 2).

Participant Observation

I used this method to examine day to day activities considered important to understanding a research question. The researcher participates in some event or looks at a place to experience what it is like and why it is important (Bernard 2000). In this case, study participants requested that I observe and experience firsthand incidences of pig activity and damage, hunting, and any other events that participants considered relevant. I resided in the CCRC area for the duration of the study. I participated in site visits to examine pig damage on farming properties, and in protected areas. I participated in hunting trips, joined the Tully Bow Hunters Club, and attended the Kurrimine Bow Hunters Club. I participated in community events and attended pig related activities that were open to the public such as pig weighing competitions. I also studied photographs of pig damage, hunting, and video footage of pig hunts. In addition, I examined the local paper, the *Tully Times* and pig hunting magazines.

Participatory Sociograms

Sociograms are visual representations of stakeholder relationships. They depict with whom stakeholders have relationships and provide information about the kinds of relationships (e.g., positive or negative) they represent. Sociograms include relevant nodes and ties (Katz et al. 2004). Nodes are points that represent each stakeholder while ties are lines that describe the relationships. For example, a one way line with an arrow may describe a relationship where one stakeholder provides information to another (Katz et al. 2004; Wasserman and Faust 2007). The sociograms used in this study represent 'ego-centric' networks. They describe only the direct relationships between the focus stakeholder and other stakeholders (Bourne and Walker 2005; Hanneman and Riddle 2005; Katz et al. 2004; McCarty et al. 2007; Wasserman and Faust 2007). Sociograms used in this study depict the social landscape as perceived by stakeholders. These 'social maps' represented the landscape of the feral pig resource system through diagrams created by participants that described the socio-political relationships between hunters, farmers, and other stakeholders.

I conducted individual sociogram-making sessions with all the participants I interviewed. During a sociogram session participants were given the option of creating sociograms with markers, pencil, or pen on paper. The purpose of making the maps is to investigate how stakeholders perceive they are connected to other participants associated with feral pig management. A participant depicts himself by drawing an oval with his name at the map's center. Other stakeholder ovals circle this center oval as indicated by the participant's placement of them. The types of ties between participants used here are adapted from Wasserman and Faust (2007) and provide information about: the charge of the relationship (positive or negative), the directionality of the relationship (which individual shares information with whom), and

relationship type-whether relationships are mutual (information or resource sharing) or unidirectional (e.g., one person provides information to another without reciprocation).

Data Analysis

I indexed all the data collected, including oral histories, interviews, participant observation, sociograms, and notes derived from all research activities using mnemonic codes. The code names are derived directly from concepts in the study (e.g., SOC for social, PIG for feral pig; Bernard 2006; Miles and Huberman 1994). These codes were used with date, note number (consecutive identification of notes and interviews), and delimiter codes (these codes help a computer to identify the beginning and end of each item) to quickly identify and locate notes, interview transcripts, etc. about specific topics (Miles and Huberman 1994). I used the qualitative data analysis computer software package NVivo to analyze the collected data (Miles and Huberman 1994).

I analyzed the data using qualitative methods. I used grounded theory to categorize and derive concepts from texts and to link these concepts into substantive and formal theories (Strauss and Corwin 1990). Codes and major themes describing the perspectives of hunters and farmers regarding feral pig management were derived directly from analysis of transcripts and photos; codes were inductive, meaning that they were not conceived prior to data analysis. I used a process of triangulation to compare the results found in the interviews, discussion groups, sociograms and participant observation. The codes and major themes that evolved from the grounded theory process were used to create a basic theory about the results. Aspects of this theory were described using frame analysis (Mills et al. 2007; Rydin 2003).

I examined the data resulting from the sociograms using a matrix to compare stakeholders (row labels) with the kind of relationships (column labels) they held with other

stakeholders. The relationship columns used a three point description- positive/strong relationship, intermediate relationship, negative/weak or no relationship. A strong relationship was one in which stakeholders shared the most ties and a weak relationship was one where stakeholders shared the fewest ties. A positive relationship occurred when stakeholders were happy with their connection with others and shared satisfying exchanges. An intermediate relationship was one in which there was a mix of positive and negative exchange or in which a relationship was simply equitable. A negative exchange occurred when stakeholders felt a deep dissatisfaction with communication with others. No relationship describes the case when there is not exchange between stakeholders. Stakeholders are aware that these other participants are involved or should be involved in pig management in some way, but they share no personal ties to them.

I based the matrix data analysis on the results of the maps and also participants' responses to questions about these maps as well as their descriptions of stakeholders in interviews. For example, a stakeholder might describe 'no relationship' as being negative, because no relationship exists where there should be one. An 'intermediate relationship' could be intermediate for a number of reasons. For example, it could be intermediate because a stakeholder shared positive information with another stakeholder and received negative feedback. It could be intermediate because the two groups share some regular exchange and were said to, like any relationship, contain positive and negative moments. It could be intermediate because there was some regular exchange, but this exchange was not charged-for example a hunter might pay x dollars to a shop owner to buy hunting equipment and receive the equipment with payment.

Results

Below, I describe the results for each stakeholder group organized according to stakeholder identity and whole story frames. I first profile the stakeholder groups of farmers, hunters and TOs. Environmental and agricultural managers were grouped under the basic identity frame 'managers', and their identity and whole story frames were described for this broader category. Finally, I briefly describe other stakeholders whom I individually interviewed due to their perceived relevance to the study. All views expressed in this section, unless otherwise stated, represent those of the various study participants.

The Farmer/Grazier Profile

Identity Frame

The farmers interviewed for this study represent constituents of each of these agricultural industries: banana, cane, tropical fruit, timber, and cattle. They ranged in age from 35-67 and represent a diversity of cultural heritages. Some farmers have convict heritage or have officers as ancestors from the United Kingdom and Ireland, others have the Portuguese, Italian or Chinese heritage that reflects some of the historical migrant populations in the region. There is variation in their levels of education; some completed their schooling at the junior high school level, while others have university degrees, and one has a Masters degree. Twelve out of the fifteen farmers were born and raised either in the CCRC or in a neighboring shire. These twelve locally born farmers grew up on properties where agricultural land and practices have been handed down through the generations.

The remaining three farmers are considered 'new' farmers. One of the three was born in the CCRC area, but his family was not of farming heritage and he came to farming after living in another area of Australia where he had pursued another career path. He has been a farmer for

approximately 30 years. The remaining two ‘new’ farmers are thus labeled because they were born in other parts of the country and moved from other professions to become farmers in the CCRC area. One of these two farmers has been growing crops for approximately 9 years and the second has been a farmer for 2 years. The former farmer has ties to the region through his wife. The plantation manager, who has lived in the area for two years, was recruited to his job at ITC and has no personal ties to the region.

The connection to the land in CCRC is an essential defining characteristic of the ‘farmer’ identity. For long-term residents born in the region, this connection is based on heritage, the intergenerational connections to the land, and the practice of farming in the region. Some love farming for itself, others fell into it only because of their heritage connections, others had a connection to the region itself, but for the remaining ‘new’ farmers the connection is based primarily on a love of farming and of the landscape found in CCRC. All the farmers have an economic investment in their farms. The farms are part of their daily lives. The farmers all spend significant amounts of their time managing the properties and most live on these properties.

Whole Story Frame- Farmer

There are five aspects to the description of the pig management whole story frame. These revolve around beliefs and values about pigs, pig management values, the role of pigs in the environment, the kinds of management tools being implemented and challenges associated with pig management.

Pig Attributes

According to the farmer participants, pigs are hardy, adaptable, they reproduce quickly, and have large litters. Pigs are intelligent, and will quickly change their movement patterns to

protect themselves from danger. They also learn from experience to at least temporarily avoid some forms of pig control making it difficult to successfully control them.

Pig Management Values

Pigs are considered a pest species by all the farmers who participated in this study. They are an introduced species that farmers do not believe belong in Australia. Farmers are most concerned about the economic cost accrued by pig damage, and they feel that, unchecked, pig populations and associated pig damage will increase over time. The farmer ideal would be the complete eradication of pigs. Farmers believe that pig populations, however, are so pervasive that it will never be possible to eradicate them, only to manage them. There is a deep sense of frustration and hopelessness associated with the inability to successfully control pig populations; 'the unstoppable pig' has been a factor that has influenced some farmers to retire early from farming. For farmers, pigs are an important management concern, but so are other farm maintenance issues such as weed and rat control. It is for this reason that regular farming practice tends to incorporate the most time efficient management methods to control pigs, even, if they are not the most economical.

Pigs In The Environment

The primary damage that farmers identified occurs in cane, followed by bananas and other tropical fruit. Farmers find it difficult to quantify the exact amount of damage because of the way damage occurs. There is direct damage caused to crops, when, for example, cane plants or fruit are consumed by pigs, but there is also collateral damage. Pigs damage not only the cane plants they consume, but also trample and kill surrounding plants as they forage. They also damage trash blankets, which are layers of cane leaves and tops that are spread around the cane as a type of mulch (Gillard 2010). Damage to trash blankets is detrimental to cane growth

because this layer helps to maintain soil health and moisture, reduce the need for herbicides by providing weed control, the blankets maintain microbial biomass, and deter soil erosion (Gillard 2010; Meier et al. 2006; Pankhurst et al. 2003).

Because cane plants reshoot after a harvest, pig damage can affect several cycles of cane growth and harvesting. Pigs also cause soil erosion- degrading banks and water ways- as they root and dig. When a pig eats cane it focuses on the center of a paddock, so often the cane damage is not noted until the crop is harvested. Damage may occur to only a portion of an acre, but this can lead to the loss of an entire paddock. This is because when the mill accepts the cane from the farmer they check the quality when it is crushed. Two measurements are considered, the Purity Coefficient and Commercial Cane Sugar (CCS). The Purity Coefficient is a percentage that reflects the amount of sucrose found in the total solids content of juice. The higher the purity the more sucrose is present. The CCS index is a percentage representing the total amount of recoverable sugar in cane (Hogarth and Allsopp 2000; Sandell and Agnew 2002). If the purity is below 70 and the CCS is below 7 the cane will most likely be labeled 'condemned'. If that occurs, the cane will be destroyed (G. Shuster, unpublished data). The farmer will lose not only the value of that cane, but will also have wasted the money he invested into harvesting the cane.

A farmer whose paddock is damaged by pigs is most likely to choose not to cut an acre where damage occurs because it would be more costly to pay the harvester, load and ship the cane, and have it condemned than to leave the damaged cane in the field. Therefore, even if cane damage in a paddock may appear to be relatively spread out and minimal, it can result in the loss of the entire paddock of cane. Pig damage can cause the farmer to change his agricultural practices and stop growing particularly susceptible crops or stop growing in certain fields were pigs are prevalent. For example, one cane farmer, no longer grows cane in selected paddocks

near the rainforest. Paddocks near the rainforest are considered to be more susceptible to pig damage than those surrounded by cultivated land. Another farmer gave up growing watermelons because on multiple occasions pigs raided and destroyed this crop.

Banana damage has a different kind of impact. Some banana farmers are actually glad to have a few pigs in their paddocks as they help 'clean up' the fields. The pigs eat any leaves or bananas that may fall to the ground. Banana trees can recover from mild damage to the trunk. The real problem occurs when pigs pull bunches off the trees or knock down entire trees to eat the bananas or eat the centers out of banana plants. Pigs also love other fruits and will damage trees to get to them. Tropical fruits and exotic vegetables are often grown in relatively smaller quantities in comparison to cane and banana. These tropical fruit and vegetables also have higher economic value per fruit. Therefore, damage can be more costly- such as the case with watermelon and taro.

All farmer participants also fear that in the future pigs may spread disease to cattle or other domestic species causing a negative impact on national agricultural industries. Pigs also transfer weeds through their droppings and when seeds and plants cling to their coat. Some farmers point out that pigs are an important cause of environmental damage. This includes the loss of wildlife due to direct predation, such as the consumption of frogs, the eggs of ground laying birds, and through competition for native food sources; e.g. pigs eat cassowary foods.

The estimates provided for pig damage in this study were highly variable. Six farmers found themselves unable to quantify the exact amount of damage while one banana farmer said he had had no pig damage in the previous year due to current management actions. The remaining farmers estimated damage between 0.2-50% of their income. All farmers were hesitant to quantify pig damage using any kind of statistic and some felt that it is nearly

impossible to statistically measure pig damage on farms due to the types of collateral damage described in this section.

Management Tools

Farmers fear that, unchecked, pig populations and concurrently, pig damage, will increase over time. The ability of pigs to learn and adapt means that control methods such as trapping are often hit or miss; pigs learn to evade traps. There is no one management process that is considered satisfactorily effective so farmers tend to use a mix of methods to conduct pig management. Farmers tend to reach for the most time efficient methods to keep pigs in check, which are not necessarily the most economical, and the farmers I spoke to indicated that more effective management methods are needed.

Electric fencing is effective for preventing pigs entering certain areas of a property. When used correctly it is particularly effective for protecting high value or favored pig crops such as taro, melons and pumpkins. This kind of fencing, however, is extremely expensive and requires extensive and regular maintenance. It also does nothing to manage pig populations; it simply displaces them to other properties. Trapping is considered effective, but many farmers say that traps only collect a certain type or size of pig and experienced pigs become trap shy. These types of 'problem' pigs will not be collected. Farmers are also aware that another challenge with traps is that they can also catch wildlife unintentionally. Poison bait is used, but some farmers will not use it or will use it sparingly due to potential damage to dogs and wildlife.

Farmers also mentioned that another option is to ask hunters to come onto the property or for farmers to go hunting themselves. Hunting requires no maintenance. Trusted hunters are allowed on properties and the farmers indicated that hunters are particularly effective at catching problem pigs and can monitor pig populations on the property. Hunters recruited for this purpose

are pig doggers (individuals who use dogs to hunt pigs) or rifle hunters, but some may also trap. Bow hunters are not recruited, but they may be allowed on a property to hunt. It is believed that bow hunting is not an effective tool for managing pigs. Hunters may not take large numbers of pigs, but they provide sustained pig control and in combination with other management methods can help reduce pig numbers. Innovative methods for pig control continue to be developed by hunters and farmers for use on agricultural properties such as the use of pit traps, original trap designs and combined use of fixed overhead spotlights and banana bait.

Pig Management Challenges

There are several challenges that farmers consider important to pig management. Farmers consider pig damage to crops to be the worst at forest/ paddock boundaries. They generally feel that land bounded on all sides by cultivated paddocks lack sufficient shelter and camouflage for pigs. Pigs do not enter these properties because either farmers on rainforest borders manage the pigs or pigs get sufficient feed and feel safer in areas close to the rainforest rather that open spaces between properties. On the other hand, the tropical rainforests and swamps that dominate the region provide excellent cover. There are farmers who experience little or no damage because their properties are bordered on all sides by other farms and because farmers near the forests enact pig control. Properties near forested or swamp areas serve as buffers zones that pigs do not cross. Farmers consider public lands problematic for other reasons as well. They create management challenges other than harboring pigs. The rainforest is fairly inaccessible for trapping or other pig control methods. This is both due to its dense vegetation and because of regulations that prevent farmer access to manage these public lands. The rainforest also provides shelter to native wildlife which can be susceptible to some pig management methods. Farmers

have to take care what methods they use for controlling pigs to help prevent accidental injury or capture of wildlife.

There are other challenges for farmers aside from that found in the physical environment. Farmers have limited time and funds to allot to pig management. This limits the timing and strategies that can be used to control pigs. There is also a deep frustration and anger with perceived lack of dedication and involvement of other stakeholders in management. There is a need for innovation in pig management methods. Federal pig programs fail to provide long-term sustainable actions and funds. Farmers feel that managers, government representatives, contracted pig managers, and the tourism bureau do have, or else should have, involvement in pig management. While some farmers who do not have pigs on their properties are concerned with and involved with pig management, farmers participating in pig control feel that all farmers should be involved in pig control. Farmers also have to deal with another management challenge; the occasional trespassing by what they believe to be poachers on their properties. Poachers are hunters who trespass and/or vandalize farm properties. Additionally, farmers that participate in pig control feel like their efforts and values regarding pig control go unappreciated. They feel that government pig control programs fail to communicate adequately with farmers. These programs lack transparency, and they fail to recognize, utilize and understand farmer knowledge in the area of pig management.

Hunter Profile

Identity Frame

Hunters learn to hunt in many disparate ways. They are introduced to hunting through family ties, friends, clubs, magazines, or films. There are many types of hunters that define themselves as part of this group including pig doggers who hunt with dogs and use a gun or a

knife to kill the pigs, rifle hunters who hunt only with guns, bow hunters use bows for hunting, and pig trappers may use a varied assortment of pig traps and guns to catch and kill pigs. Hunters all take great care with their weapons of choice. Some rifle hunters are gun collectors; e.g., they may enjoy the history of old fashioned rifles. Some bow hunters make their own recurve bows. Most pig doggers prize their dogs and take great care with them. They are often a part of the family and some hunters provide special armor to protect their dogs when they hunt. The 15 hunters interviewed represented hunters from each of these categories (Table 1). All these hunters were recreational hunters, but three of the participants had also hunted professionally. Hunters generally ask permission from farmers to hunt on their properties.

A hunter's relationship to place is different from that of a farmer. Identification with a particular place is not a necessary attribute to the basic identity frame of a 'hunter'. While all but two of the hunters grew up in the CCRC area, the remaining two hunters were temporary residents to the area and were widely accepted by the hunting community. One of these two hunters was a regular traveler up and down the east coast of Australia. He worked and hunted as he went. The other temporarily lived in the region due to work commitments. Most hunters participating in the study, in addition to hunting locally, also travelled to hunt in other regions. Popular hunting locations for pigs included places such as on the Cape York Peninsula to the north and Charters Towers to the south-west. Recreational hunters sometimes travel further afield planning special trips to hunt in other Australian states and territories or internationally. These trips are not always for pig hunting, but also to chase other game species. Some have made trips to hunt in the United States and participated in hunting safaris in Africa. The concept of place, however, does have a role in the definition of a hunter. Hunters tend to 'collect' properties on which to hunt. There can be overlap in the properties used by hunters, but hunters

also have prized hunting spots whose location they choose to share with only a select few. The type of species hunted is also not a defining characteristic of a hunter. Several hunters, for example, have had experience hunting other feral species such as cats, deer, and camels and internationally, animals such as gazelle, and water buffalo.

Hunters work in a variety of professions. The ones participating in the study worked in a spectrum of fields including laborers, farmers, builders, engineers, some worked for the mines, one is a national parks ranger, and one is an environmental manager. Profession did not define a hunter in this study. The unifying identity for a hunter revolves around hunting itself. Hunting or hunting related activities are an integral part of weekly or monthly routines. Hunting is valued for a number of reasons. It is a form of recreation, and provides a way to relax at the end of the day and forget about every day stresses, offering an opportunity to be outdoors. Hunting is also about ritual; there are ways of taking down the pig, preparing and using the dogs and dressing pigs for consumption. Hunting is an arena for friendship and offers an opportunity to make new friends or strengthen existing social bonds. Hunting is about tradition; it is a skill that can be passed down through generations.

There is also tradition in the sense of connection to human origins – the pride of hunting one's own food and practicing survival skills. Another aspect that is valued is the challenge of the hunt. It is an activity that provides the danger of serious injury. There is the challenge of refining and improving your abilities - improving aim and technique as well as improving strategy for finding and outwitting pigs and taking them before the hunter is detected and the pig can escape. It can be a competitive activity: many hunters have a passion for trophy hunting which involves finding the biggest pig, the biggest pair of tusks or the pig that outsmarts the hunter. For some, there is the satisfaction of providing assistance; contributing to the community

by assisting farmers with pig control and the satisfaction of eliminating one more pest animal from the local environment. Hunters also feel they make a significant contribution to the Australian economy in the form of purchasing camping equipment, weapons, video, magazine, gas and other necessities.

There is a fairly unified set of norms regarding hunting, the choice of hunting spots, treatment of hunters and other stakeholders, and treatment of dogs. Hunters who breach norms regarding property access and relationship guidelines with farmers are said to be 'poaching'. The boundary between a minor breach of norms, and defiling those norms, varies somewhat among hunters. Several participants confided that they crossed property boundaries without permission either to follow a dog, because they went out with a new hunting companion who took them into a new area, or because they were following old hunting tracks. Most of the hunters who participated in this study either had negative perceptions of hunters who left rubbish or stole items from properties, or thought of them as young and inexperienced.

Whole Story Frame

Pig Attributes

Hunters do not consider pigs to be pests, but rather intelligent, perceptive, adaptable, tough animals with a keen sense of smell. All of these features make pigs a challenge to hunt. They can use their sense of smell to detect prey or hunters from afar, and they learn to evade traps, attack dogs and hunters. They are well adapted to the Australian environment and so have excellent camouflage. According to the hunters, they have no real predators in the CCRC except snakes or dogs that can take a small pig, although in the region of Cape York Peninsula hunters said that a group of dingos would kill large pigs. For hunters in this study, pigs are a capable opponent and care must be taken when confronting one to avoid serious injury. Hunters also

indicated that pigs can damage local ecology, causing erosion, consuming wildlife and competing with wildlife for food. Hunters expressed awareness that pigs are a problem for some farmers, causing crop damage and carrying disease.

Pig Management Values

Hunters feel that pigs are for hunting. For most hunters, the purpose of hunting is not pig control. Hunters enjoy the activity of hunting pigs. They respect pigs for their intelligence, strength, and the danger they can pose. Many enjoy trophy hunting. This does not mean however, that hunters do not care about pig control. Hunters are fully aware of the damage pigs can cause. Some hunters feel that when they take out a pig they are assisting the local environment and farmers. When hunters are asked to take out particular pigs for farmers they take the task seriously. They are not overly worried about the activities of pig control programs because they feel pigs will never disappear. However, they do become concerned if management activities encroach on their access to hunting areas.

Management Tools

The hunters in this study said that they are regularly contacted by farmers to manage pigs on properties. Hunters believe the best ways to control pigs are with guns, dogs, or traps. Traps will work, but pigs eventually become trap shy and traps only collect smaller pigs and sows, not big problem pigs. Poison baiting is a problem because it kills wildlife and can also kill dogs, not just the pigs that are targeted. Bow hunting is not effective for catching large numbers of pigs so bows are not a feasible management tool. Many hunters feel that they should have access to public lands in a manner similar to that given to hunters in Victoria where members of sporting shooters' clubs are allowed into state forest under a closely regulated program to hunt pigs. The

hunters in this study expressed great frustration that they could not gain access to certain areas to remove pigs, because of government regulations.

The Challenges Of Pig Management

Pigs are hunted on private properties and also illegally in protected areas. Hunters indicated that it is easier to find pigs in the arid areas of the cape because the need for water forces pigs to collect at water holes. In CCRC, it can be more difficult to hunt pigs, because there is an abundance of water and the density of rainforest vegetation makes it difficult for hunters to maneuver. Land tenure is also a concern, because it can inhibit access to private properties and protected areas. New pig control programs can cause frequent changes in hunter access to properties. For pig doggers, one type of access challenge stems from the fact that dogs and pigs may cross property boundaries and so it can be difficult to obey access laws. There is also a strong stigma associated with hunting in the community. This can make it difficult for hunters to build social capital in order to gain access to new properties to hunt. Lastly, hunters indicated that revised gun regulations have negatively impacted hunters by increasing the cost of hunting or causing hunters to reduce the number of guns owned.

Traditional Land Owner Profile

Identity Frame

Four of the five participants interviewed were members of four mainland groups of CCRC- Djiru, Girramay, Jirrbal, and Ma:Mu and were all elders in their communities. They work in a variety of professions in the fields of art, education, as council workers, and one as a retired cane labor/environmental consultant. The final interviewee worked in a management field. He primarily grew up in Cardwell and Tully, but his family group heritage was from elsewhere. He was unable to tell me to what TO group he belonged; he mentioned he believed

his heritage to be lost. He said, however, that his family was accepted as belonging to the indigenous communities of CCRC. Regardless of where they were from, all participants felt a connection to the land on which they lived and worked. They also all had strong ties to the local indigenous community. The participants ranged in age from 35 to 74.Their formal education varied from six years of schooling to completion of high school. Due to the turbulent nature of the shared histories of TOs and colonists in the region, elders had limited opportunities for formal education while growing up.

For this group, pigs are used as a food source. The meat can be served during special occasions such as initiation ceremonies or funerals where the meat is buried and cooked with coals underground. However, as a result of the appearance of tuberculosis in pigs, and the availability of meat at supermarkets and butcher shops, pig meat is less popular. These TOs do not generally hunt pigs for recreation. The TOs mostly hunt with guns. The pigs were often found while working on properties as laborers or while foraging for other food sources. Knowledge of pig food plants and pig tracks is a useful way to find pigs when deliberately hunting them. For example, it is known that the nuts at the bottom of what are commonly called the bulgaroo plants are a favorite food for pigs. Therefore, TO hunters might search for pigs in swamps where these plants occur. Pigs can also be acquired from other community members or from passing TO or non-TO hunters. TO interest in pig meat is familiar to many non-TO hunters so sometimes these hunters will phone TOs and offer pig meat they plan to collect or have collected during a hunt. They may do this in particular if the hunting has occurred on TO properties.

Whole Story Frame

Pig Attributes

Pigs were described by TOs as hardy, tough, resilient, and intelligent. Pigs reproduce quickly and successfully. They eat vegetation, wildlife, carcasses. They create distinctive "highways" in the bush that are regularly and well used. Pigs were once predated by dingos that hunted them in groups, but there are now no dingos in CCRC. The carpet pythons of the region are predators that do still eat pigs.

Pig Management Values

Pig populations should be controlled, but they will never be eradicated according to TOs. Four of the participants were quite concerned with pig damage, while one participant said he wasn't too concerned about pigs except occasionally when they dig and cause erosion at creeks. He felt pigs were mostly a concern for farmers and he didn't mind having some around to eat. All TO participants were interested in, or would be happy to participate in, pig management. One stakeholder was already participating in pig control through his profession and another had applied to work as a contractor in pig control with a local non-profit management agency. All but one of these TOs has pig hunting experience.

Pigs In The Environment

The TOs that participated in this study acknowledged that pigs are an introduced species, but they have been here long enough that they are now considered part of the landscape. Pigs damage traditional sacred sites and cause environmental damage such as erosion, damage to vegetation, destruction of revegetated areas, and they eat wildlife, eggs, and aquatic life, e.g., prawns, eels, and jungle perch. Pigs carry disease and compete with native species for food.

They also affect bush turkey behavior; turkeys build nests in raspberries to try to protect nests from pigs that dig out the eggs.

Management Tools

TOs participating in the study were happy to have pigs managed, though, for one participant, management was not a priority issue. Most participants were not fond of pig dog hunting activities. Dogs can be seriously injured by pigs and wildlife is killed by dogs. Two participants, however, had some experience of hunting with dogs. TO participants preferred organized pig programs that include such methods as trapping, but generally did not approve of poison baiting, because of the damage it causes to wildlife. For example, baits are frequently consumed by lizards such as blue tongues. There is also the concern of the poison entering waterways and indirect poisoning as a result of eating animals that have eaten the baits. TOs are also concerned that wildlife can be caught in traps incidentally. Shooting, particularly aerial shooting, is considered effective.

Pig Challenges

TOs mostly felt that they were not given sufficient opportunities to participate in pig management. They said that while managers occasionally contacted them, they never followed up initial contact. As traditional land owners of the country that is CCRC, they feel they should have a right to participate in pig management and not just as QPWS rangers. They feel the terrain in CCRC area makes management challenging and access limits are also a challenge. Government organizations are not active enough in regards to on-ground pig management actions. There is a sense that management should be more participatory; all stakeholders should coordinate management actions together. There is a lack of sense of community as regards the management of pigs, and a lack of understanding or appreciation of the role of land to pig

management practice. Two participants described a deep desire to continue the process of teaching young people about indigenous culture including pig hunting. Both these participants were involved with programs for young people for that purpose. The dramatic changes to the landscape that have occurred since the introduction of pigs have caused their numbers to increase. These changes include increased availability of pig food plants; the clearing of once dense forest, which allows easier travel access for pigs; and human infrastructure such as irrigation drains, which also provide easy access to food and water.

Manager Profile

Identity Frame

The basic identity frame of these participants, as they regard pig management, associates them as 'managers' and they have an official position within the organizations with which they work. They share a sense of responsibility for their work and generally their work goals. It is not a pre-requirement for holding these positions that managers be from the region. Instead, they are required to hold particular training and experience in their fields.

Outside of a sense of responsibility to the particular area where they work, and for most a general sense of being separate from the local community, no shared sense of place exists amongst managers. The reason for the lack of uniformity in sense of place is that for the jobs they occupy, managers are not required to be from the region. These participants come from a range of areas. Some are local, but some are from other parts of Australia and some arrived at their positions from international destinations. The origin of residence does not determine sense of place. Some managers from distant locations consider the area home, but not others. Local residents often have a local sense of place, though not always, and within the bounds of their roles, these managers often still consider themselves separate from the community. Even the

sense of place about the area where they work can vary; this may be the particular piece of public land on which they work, or for a few, it may be more encompassing of the region as a whole.

Whole Story Frame

Pig Attributes

The managers that participated in this study viewed pigs as intelligent, hardy animals that breed prolifically, have an inherent sense of danger, and can learn trap avoidance. They are considered a nuisance by these managers. An import to Australia, this group believes pigs do not belong in Australia and are very destructive. Despite this, the managers believe that pigs are now a permanent part of the landscape. In the CCRC area, there are no predators that can impact an adult pig. Pigs are economically significant to people working in agriculture because of the financial losses resulting from crop damage.

Pig Management Values

Managers feel that pigs are a pest, but they are not the top priority in land management and crop production. There are many concerns such as weeds, emerging pests, crop disease, and fire control that take precedence. The management focus is on the lands designated to a particular organization with some consideration of neighboring properties. Most managers feel they share good communication with the public. Pigs are the most important feral animal pest. Managers feel pigs will never be eradicated, and that pig management is particularly important for public relations management.

Pigs In The Environment

Managers agreed that pigs cause moderate environmental damage compared to that caused by weeds though they do cause the greatest feral animal damage in this area. They cause minor damage in protected areas, though they can cause some significant localized damage. Pigs

feed on tubers, worms, roots, and can leave areas open to weed infestation; they also create wallows, and eat eggs which may be a concern for cassowaries, scrub fowl, goannas, crocodiles and turtles and have the potential to spread disease. Pigs are economically significant to people working in agriculture because of the financial losses resulting from crop damage.

Management Tools

Traps and opportunistic shooting are used in national parks. Traps can also be loaned to neighboring properties to catch pigs. There are challenges to trapping, including poor access through the forest due to the density of understory vegetation which makes it difficult to manage pigs in the area. After a period of habituation, pigs avoid traps so there is no point leaving them out for long periods. In this region, aerial shooting is not possible, because it is too difficult to protect visitors from danger and because of the density of the vegetation. Also, because of the abundance of water, pigs are widely dispersed in forest. Poison baiting occurs in select locations and can be done on request for private landowners. Hunting is not allowed in any protected area. Contractors have been and are contracted to undertake pig control work in various areas in the region. This usually involves trapping and or baiting.

Pig Management Challenges

The focus of environmental managers is on natural resource management. For the on-ground management arm for protected areas, there are many management activities that need to be undertaken with limited staff, equipment and time. Pig management is not a top priority. The management of pigs is also not a straightforward process. There are many challenges to pig control. While environmental managers have most management tools on hand - staff, some traps, bait, guns and ammunitions - staff time is limited. Each method used for pig control has its own unique set of challenges. Trapping is labor intensive. The forest density means that traps are only

set on trails and walkways. Pig shooting requires special accreditation through the agency. QPWS, for example, has many staff with gun licenses, but only a couple with special training and accreditation to be able to shoot pigs. Insurance is also a consideration for any pig management activities. Due to the mobile nature of pigs, control efforts cannot be successful without coordination between government organizations. Environmental managers, therefore feel that pig management needs to be integrated between catchments.

Funding of pig programs is a contentious issue for all managers. Most managers feel that there is sufficient funding available even if there may not be significant funds designated specifically for pig control. Occasionally special funds for pig control are administered for political reasons when stakeholders make a significant complaint about pigs, or when politicians are looking to win votes. These funds might be funneled into hiring contract pig trappers, for example. Also, on-ground managers complain that the timing of funding cycles often do not coincide with the period of need for the funding on-ground and the provision of funds primarily occurs in response to a PR need.

In addition to these management challenges, managers also contend with physical destruction of management tools. Various protected areas and council lands had their traps and restricted access signs vandalized or stolen and perimeter gates removed. Managers also believe that some hunters deliberately breed or catch and then release pigs onto protected areas in defiance of pig control actions.

Others

It is worthwhile to also briefly mention the perspectives of the other stakeholders that farmers considered important to pig management. The management values of government representatives differed markedly from other managers. These representatives felt pigs cause

significant damage to farmers and the CCRC environment, and greater government funding and more effective management actions should be applied for pig control. They felt that their constituents' concerns were not being adequately addressed by on-ground managers.

One manager, who worked regularly on the ground with pigs, considered feral pigs to be an important pest species that causes significant damage to agricultural crops and the environment. The damage to crops is variable depending on the time of year and the value of the crops themselves. According to this manager, regular long-term management is needed in order to keep pig populations under control.

Another stakeholder group that farmers and hunters consider relevant to pig management is the tourism industry. Two prominent members of the tourism community spoke to me about their views. Pig management issues were generally not a consideration in their work. They did not have a clear understanding about pigs or the role of pigs in the environment. They did not have knowledge of pig management tools, but were aware that QPWS and Boar Busters have a role in managing pigs. They felt QPWS and Boar Busters should continue their activities because this was a part of their general responsibilities.

The local veterinarians were a stakeholder group that was considered particularly important to pig doggers. The vet involved in this study was part of the partnership of four veterinarians who run various clinics in the CCRC. This vet regularly cared for pig dogs and also had a key role in providing health care for wildlife being rehabilitated in the region. He considered pigs to be adaptable and hardy, and able to attack and injure dogs. According to this veterinarian, pigs cause problems for farmers, damage to the environment and wildlife, and are pervasive in Australia. From his perspective, the greatest concern is the spread of disease and parasites by pigs, both the active spread and potential transfer of illnesses in the future. For

example, hoof and mouth disease could potentially be spread to domestic livestock through pigs. Meanwhile, there are concerns about the transfer of the screw worm fly from the neighboring Torres Strait Islands to feral Australian pigs. These flies cause open wounds and infection in livestock.

The vet acknowledged that there are challenges to effective pig control. The density of the rainforest in FNQ makes access for pig control difficult, and the adaptable nature of pigs makes it difficult to apply management tools effectively. Still the control of pigs is paramount to the Australian economy, health, and the environment. The vet felt that the government and managers knew about pig problems, but they were not really conducting any major management schemes. He acknowledged that there were a few small management projects that the government conducted, but these would have little impact due to their small scale. The government is also slow to respond to the pig problem. Meanwhile the vet felt that veterinarians in general are doing what they can to assist in pig control. There are veterinarians in Australia who are conducting research into pig control, for example by examining poison baiting techniques

Discussion

All intractable disputes are long-term issues that evade resolution, but these kinds of conflicts differ in their conflict drivers (Dewulf et al. 2009; Furlong 2005; Lewicki et al. 2003; Moore 1996). The way stakeholders frame environmental conflict impacts how these conflicts form, escalate and evolve (Lewicki et al. 2003; Schon and Rein 1994). Through the initial examination of stakeholder identity and whole story frames for pig management, we can examine data, values, structure, initial relationship, and interest drivers for the conflict.

Data

In describing conflict, Buckles and Rusnak (1999) suggest that conflict is partly a product of poorly understood ecological relationships. In the case of pig management, there is a lack of clear and sufficient data. There is a lack of clarity among pig management stakeholders as to whether pig control should even be a management concern. Managers depend on research literature to help determine the level of importance of pig control. Many studies document that pigs do cause environmental damage however, pig damage is difficult to quantify (Choquenot et al. 1996; Izac and O'Brien 1991; McGaw and Mitchell 1998; Mcllroy 1993; Tisdell 1982). There are no consistent methods for measuring damage, or concretized criteria for defining the kinds or quantities of damage that are considered to be threatening to the environment. Those that do quantify damage are often in disagreement about the significance of the levels of damage to ecological processes (Izac and O'Brien 1991). In 1991, pigs were estimated to have cost sugar cane farmers AUS$628,000 equivalent to a reduction in yield of 25,510 tonnes (Mcllroy 1993). These were considered significant amounts. Mitchell and Dorney (2002) however, placed yearly damage for cane and banana growers at AUS$576,586 per year, which he did not consider a significant amount of damage. There is the added contention that there can be significant variation in results examining the same types of damage. For example, Noble (1996) estimated the cost of pig damage for banana growers in the CCRC area at AUS$1800 per month as proscribed to him by growers. Mitchell (2002) suggested that the damage cost to banana growers was AUS$4,099 per year. Meanwhile, the cost to agriculture in Australia is estimated to be at least AUS$100 million dollars of damage (Choquenot et al. 1996). All these studies however, qualify their results describing the difficulty of accurately measuring the economic damage caused by pigs and extensive variability of damage between farms.

There are also some studies that examine damage caused to wildlife and vegetation in protected environments (Alexiou 1983 ; Bowman and Mcdonough 1991; Fordham et al. 2006; Fordham et al. 2007; Statham and Middleton 1987). The primary cause of death for Northern snake-necked turtles (*Chelodina rugosa*) was predation by pigs with a 96% mortality rate (Fordham et al. 2006; Fordham et al. 2007). Meanwhile pigs have been found to cause minimal damage to vegetation in wetlands (Bowman and Mcdonough 1991). Alexiou (1983) found pig damage along 32% of drainage lines in subalpine regions in the Australian Capital Territory. This damage resulted in poor revegetation by native plant species. Statham and Middleton (1987) reported significant damage to moist gully habitats on Flinders Island in Tasmania that lead to general erosion, vegetation destruction, and recruitment of bracken fern in the revegetation process leading to denser 'impenetrable' undergrowth. The variability found in pig damage studies has resulted in management decisions that are primarily value driven. These kinds of decisions lead to conflict because the multiple stakeholders involved in management also have multiple value systems.

Value Issues

Value issues occur when there are fundamental differences in beliefs, in this case, about some key aspect of feral pig management (Buckles and Rusnak 1999; Lewicki et al. 2003). One of the key differences between stakeholders is the level of importance that they attribute to pig damage (Table 2). In addition to using literature to determine their management decisions, managers base their perceptions of pig damage on their experiences of damage in the field. Managers acknowledge that their observations are based on the examination of pathways and fire trails in the areas they protect. They do not enter the forest to any depth due to its density. These visual determinations of pig damage are based on limited evaluation of the environment in which

pigs range; they are dependent on the evaluation of pig damage only in areas of high human traffic.

Farmers, hunters and TOs base their perceptions of the importance of pig damage on their daily experiences with pigs on their lands. This knowledge is based on experiences collected over time and shared between members of the same stakeholder groups. Farmers and hunters often work in conjunction so they share some of this knowledge. TOs also have some occasion to work with farmers and they share their knowledge and experience. All the stakeholders are also basing their perception of damage on different landscapes. Farmers are looking at what damage means on farms and in the forest that fringes their properties. Hunters are looking at damage on farms and in the habitat they access for hunting. The TOs who participated in this study consider the landscape where they live and work. Managers focus on their section of protected area landscapes.

The valuation of the damage is considered differently between stakeholders and combined with their different knowledge systems is used to determine how much of their limited resources they are willing to contribute to management. For farmers, most TOs, and government representatives, this damage is serious and significant. To managers, this damage is important, but relative to other environmental concerns that must be managed, it is lower on the list of

Table 2. Summary of whole story frames for pig management stakeholders.

Stakeholder	Pigs and Pig Damage	Management Tools	Management Values	Challenges
Farmer	Pigs are a pest. They cause damage to crops, erosion, and damage to the bush and wildlife.	Multiple management methods are used- traps, hunters, poison, electric fences, aerial shooting. Contract trappers are also used.	Eradication is not possible. Control of pig populations.	Dense rainforest terrain- difficult to penetrate and home to pigs. Wildlife can be injured by management actions. Limited time and funding. Lack of government support. Gun restrictions.
Hunter	Pigs are for hunting. They are legal to hunt. They cause problems for farmers and the bush.	Hunting of various forms- with dogs, guns, bows or trapping.	Hunting pigs. Sometimes eating pigs. Assist farmers with pig problems. The focus is not pig control, though pig control is ok. Eradication is not possible.	Density of bush; property access issues; gun restrictions; government restrictions.
TO	Pigs are a part of the landscape. They cause damage to sacred sites and the bush.	Minimal hunting, but hunting is usually done with a rifle.	Pig control was important to most participants. Some eat pigs. Some hunt pigs.	Forest density; loss of hunting skills; property access limits; wildlife injury; lack of government support.
Managers	Pigs are a pest. They cause some damage to the bush and are a problem for some growers.	Trapping on public lands, loan of traps, or poison bait. Contract trappers are also used.	Manage protected areas. Strategic use of management resources. Response to farmer concerns. Pigs will never be eradicated.	Multiple management priorities. Limits in management resources; density of rainforest; limited access to grower properties; public relations work.
Others*	Pigs cause environmental damage, can cause disease, and are a problem for some farmers.	Trapping on private lands, loan of traps, or poison bait. Research on pig control methods.	Pigs should be controlled Eradication is not possible.	Forest density; not enough government support and a need for sustainable management.

*Tourism is not included in this description as they do not feel they have any understanding of the pig problem, but they are happy to see pigs managed.

management priorities. Damage is not considered a significant concern to tourism. Hunters recognize the impact of pigs on farmers and the local environment, but this damage is not a high priority concern to their recreational hunting activities. When hunters are contracted as professional trappers or for those hunters whose professional capacity is in an environmental field, however, pig damage becomes a more significant consideration. The end result of multiple knowledge strategies and valuations is that there is a lack of consensus about the severity of pig damage. Management practices are thus based on conflicting moral arguments. This kind of divided long-term management becomes polarized. Each stakeholder group is entrenched in their management values and enmity develops (Dryzek 1997; Lewicki et al. 2003).

Sense of place is also another value issue. Farmers, TOs and most hunters have a very strong local sense of place and thus a sense of being part of the local community. Managers meanwhile, even local managers, when contemplating sense of place tend to create some separation between themselves and the local community where they work. Identity frames can serve to unify stakeholder groups, but can also serve to divide them (Katz et al. 2004). These seemingly disparate senses of place can create a sense of alienation between the groups.

Interest Conflicts

Interest conflict occurs in the form of the determination of appropriate management tools for pig control. Some participants felt that poison baiting is too harmful a method to use due to its impact on wildlife- these stakeholders are generally in the hunter, farmer, TO, and conservation group categories. Meanwhile, the use of hunting dogs, bows, and rifles in recreational hunting is not acceptable to managers and TOs. The disapproval of these forms of hunting was based on the opinions that 1) these forms of management are restricted by law in national parks, 2) they are not considered effective management methods, 3) shooting in national

parks must be carefully managed due to occupational health and safety considerations particularly for park visitors, and 4) recreational hunter and dog behavior is unreliable. All of the TO participants showed a dislike for dog hunting due to the damage that can result both to dogs and wildlife, but thought that subsistence hunting by TOs and also professional hunting was okay. Meanwhile, farmers were somewhat divided- most were happy to have familiar hunters, or certain types of hunters on their property, and some did not allow recreational hunters outright.

Structure

The structure of the pig management dispute is also a source of conflict. This structural conflict, as it regards identity and whole story frames, occurs in the form of the position of pigs in the landscape, land tenure, and resource limitations. The nature of pig movements on the landscape is a particular point of contention for stakeholders. Pig management concerns are reflected in trans-boundary water economics, particularly in cases where trans-boundary externalities arise and create conflict (Dinar 2006). Pigs are a moving resource that transects property boundaries and where the use of pigs in one property impacts the presence of pigs on others. Consider the analogy of a river transecting various properties. Toxic effluents are found at the head of the river and flow through the river system. Landowners at the top of the river, near the source of the toxins, are most affected. They apply whatever resources are necessary- funds, time and tools in order to provide clean water for their properties. Those at the bottom of the river system benefit from these activities and the actions at the top of the river may be sufficient to provide reasonable quality of water at the bottom of the river. On the other hand, if those at the top of the river do nothing to stave off the toxins, those at the bottom of the river are most likely to suffer as well.

This is similar to how farmers with pigs on their properties describe their management experience. These farmers (represented by landowners at the top of the river) feel they invest in the control of pigs on their properties while neighboring properties (represented as landowners at the bottom of the river) including farmers who have no pigs, and tourism stakeholders, do nothing to manage pigs and simply benefit from the managing farmers' efforts. This leads managing farmers to feel disillusioned and frustrated with current management practices. They feel that these 'downriver' stakeholders should be involved in management. Hunters would represent the equivalent of boatmen traveling up and down the river clearing as they go. Farmers that manage pigs are generally happy with the efforts of hunters on their properties. Farmers feel that the pigs come from the national parks where they shelter, but that QPWS (who would be the equivalent of a property owner at the top of the river depositing toxins in the river) does little to contribute to the management of pigs. Most environmental managers acknowledge that pigs do shelter in forest, but also say that part of the reason for the presence of large pig populations is due to the high availability of food sources on farmer properties. Hunters feel that the benefits of their activities to pig control should be acknowledged.

The vague nature of pig management legislation fails to provide clear answers about how to address the complexity that arises from the management of this kind of issue. Queensland policy only states that if pigs occupy a landowner's property, they are responsible for pig control. According to anecdotal information I collected during participant observation, many participants who feel they have little or no pigs on their properties feel they do not need to be involved in the management of pigs. They feel that the expense and resource cost that helps keep pigs off their properties should be paid solely by those residents 'up river' –those farmers that do have pigs regularly on their properties.

This kind of trans-boundary conflict leads to just as much contention within the realm of water rights management. There are numerous studies on the subject (Alston et al. 2005; Bauer 1997; Bennett et al. 2001; Bennett et al. 1998; Bielsa and Duarte 2001; Buckles and Rusnak 1999; Dinar et al. 1992; Dinar 2006; Furlong 2005; Haftendorn 2000; Levy and Sidel ; Mahjouri and Ardestani ; Moore 1996; Qaddumi 2008; Ramirez 1999; Robbins 2004; Rose 1990; Wang et al. 2008; Warner and van Buuren 2009). For the particular kind of trans-boundary conflict described for pigs, the water rights literature suggests that communication and cooperation between stakeholder groups can be particularly effective in assisting with the resolution of such conflict. The degree of cooperation varies in each circumstance- from information sharing to full shared management, but case study and common pool resource modeling have both contributed to this belief (Levy and Sidel ; Mahjouri and Ardestani ; Rose 1990; Wang et al. 2008; Warner and van Buuren 2009).

Economic valuation has also been considered of importance and the benefits of both 'cost-sharing' and 'benefit-sharing' are ascribed as components of successful management (Haftendorn 2000; Levy and Sidel ; Qaddumi 2008). Dinar (2006) conducted a review of successfully co-managed international water management cases in circumstances of trans-boundary water conflicts and found that in trans-boundary conflicts, where rivers transect multiple properties, not only is cooperation an important tool for successful management, but so too is cost-sharing. He described the value of 'side-payments' to management, which refers to the provision of payments or actions from one stakeholder group to another. The benefit of the side-payment goes only to the receiving stakeholder without expectation of direct compensation (Dinar 2006). Side-payments are frequently made by downriver stakeholders to upriver stakeholders. In cases where upriver stakeholder actions particularly benefit downriver

stakeholders, this kind of compensation served as not only a way to bridge conflict, but as a kind of acknowledgement and contribution to compensate for services rendered to downstream stakeholders. Similarly, Qaddumi (2008) used game theory to explore 'benefit-sharing'; benefit-sharing focuses on the benefits received by participating parties as a result of treaty resolutions. Qaddumi found, in comparing two non-cooperative and two cooperative trans-boundary water management systems, that the cooperative systems were more successful at managing water conflict and that the inclusion of benefit-sharing contributed to this success.

One can imagine the application of these principles to feral pig management. Side-payments can be the equivalent of the incentives stakeholders described as being useful tools for creating sustainable management practices. One of the criticisms of the Boar Busters program regarded the lack of incentives to recognize the actions of stakeholders, such as farmers, who did not use Boar Buster services because they conducted control activities on their own lands. Side-payments could be provided to farmers based on the amount or kinds of regular pig control activities they conduct on their properties. These payments might be subsidized by farmers and landowners that do not conduct pig control (pig control practices are already required by law). This could take many forms such as a council tax, or fee contribution paid through participating grower organizations such as the Tully mill, Canegrowers, and/or the Australian Banana Growers council. It could provide incentives for pig control, and ease some aspects of conflict by recognizing growers' actions and concerns in regards to management. The problems associated with side payments however, include: 1) the need for a system to determine both who would be eligible to receive incentive payments and who would be required to pay them, and 2) the need for primary stakeholders to first agree to recognize farmers that enact regular pig control and that their actions can be beneficial to the community as a whole. It is important to note that farmers

also acknowledge the value in providing incentives to hunters for their activities and side payment programs could be extended to hunter actions in the form of chiller boxes or bounties.

This is where benefit-sharing can contribute to better management practices. If it is possible to find ways for pig management stakeholders to enter into negotiations together, one way to encourage multiple stakeholders to work as a team, instead of opposing parties, is to reframe management concerns. A reframing process could enable stakeholders to recognize the mutual benefits that can be gained by all parties from pig management. In order to defuse some of the conflict, the focus needs to be moved from combative to cooperative behavior by focusing on the common goal of pig management. One example of this kind of reframing is the case of the Applegate Watershed in Oregon, USA (Wondolleck et al. 2003; Wondolleck and Yaffee 2000). During the spotted owl debate of the 1980's, a mix of stakeholders, including farmers, ranchers, US forest service, loggers and ecologists, fought in the courtroom over the issue. Eventually, participants chose to deliberately reframe their positions, to act on the elements that united them as a community rather than the identity issues that divided them. One of the tools that assisted in creating this accord was the development of a group vision statement. Ultimately, they were able to work together in unison to make decisions about the management of this species (Wondolleck et al. 2003; Wondolleck and Yaffee 2000). Similarly, the shared values of stakeholders in the CCRC area can provide a foundation on which they can build a shared pig management strategy.

Another example of reframing an intractable conflict comes from the management of the Galapagos Marine Reserve (Heylings and Cruz 1998). Multiple stakeholder disputes have long existed around the unregulated industrial fishing industry. The conflict involves tourism operators, park users, conservationist, local and international fishers, and government officials. Added to the mix, the various park management authorities were unable to coordinate their

management areas and did not have the resources to enforce park regulation. The outcome of this conflict was ultimately a decline in sea-cucumber and shark populations due to illegal fishing of these species by international fishers for use in Asian markets.

In 1995, violent protests led government officials to realize that policing the conflict would be increasingly costly. In the end a consultant was called; stakeholders had been focused on their own interests, which divided the groups. The consultant reframed the conflict to focus the debate on the common problem shared by the local stakeholder groups; the exclusion of local stakeholders from marine management processes and the sense of imposed and ineffective regulations. Through the use of outside mediation and the initiation of participatory planning amongst local stakeholders (excluding international fishers), the government and local stakeholders were enabled to devise a new management direction which helped to ease the conflict. This new management process also served to initiate reframing of identity and characterization frames, through the validation and acknowledgment of local stakeholder knowledge and sense of ownership of the park (Heylings and Cruz 1998). In both these examples, reframing the management problem by approaching resource challenges with a shared understanding of the management issue, the use of inclusive participatory methods, and an external mediator helped to defuse existing conflict. Participation was an additional feature that stakeholders considered important to sustainable pig management practices.

Property rights, in the form of access, are another source of disagreement. Stakeholders have significant disagreements about how the landscape should be used to manage pigs and who can enter these spaces. Farmers and TOs both feel they should have a right to at least cross adjacent boundaries to manage pigs. Hunters also wish for greater flexibility in access between properties. Pigs move. They are not limited by political barriers. All participants feel that

localized management will not solve pig problems. Managers work within the proscribed guidelines of public lands, but they too acknowledge the importance of connectivity between council regions and between public and private lands for management. Also, there is the question of what management practices are acceptable where. Pig hunting with the permission of farmers, is legal on properties regardless of what method is used. If it moves to national parks, it becomes illegal.

Resource restrictions were a major limitation to all participants, but the specific resource that was limited for each stakeholder group differed. The limiting factors for farmers were time, funding and gun restrictions. Managers and government representatives did not generally suffer from funding restrictions, but rather from other resource restrictions such as staff and time limitations. The main limitations for hunters were access and gun regulations. The main limitation for TOs was lack of funding and opportunity to participate in pig management.

Reframing, Points of Unification

It is important to understand points of contention that lead to conflict, but it is also important to recall that there are significant points of agreement between stakeholders. I found that all stakeholders appreciate the challenges associated with devising management solutions for pigs- a species that is intelligent and adaptable. Everyone who participated in this study agreed that pigs cause environmental damage, and that it is acceptable to control pigs, but that pigs cannot be eradicated. The density of natural forest vegetation in CCRC is a significant impediment to management. The use of trapping and guns, handled professionally, was considered acceptable to all participants. The subject of property access restrictions was also significant to all participants. There were challenges associated with both access to public lands such as national parks and private properties, such as farms.

These points of consensus provide grounds for the reframing of the conflict. There is consensus between all stakeholders that pigs cannot be eradicated. Therefore, no stakeholder group is concerned that pig control will endanger their use of this resource and so all stakeholders can agree that pig management is acceptable. Some aspects of conflict may also serve as jumping off points for mutual cooperation. For example, resource limitations vary between stakeholder groups; some stakeholders have ample supplies of a particular resource, but another stakeholder group may be limited in this particular resource. This could serve as an initial point of engagement to examine how pig management resources might be better used. Additionally, while there is no consensus on the importance of pig damage, it might be worthwhile for stakeholders to undertake risk management assessments of potential pig damage to see if that has any impact on perceptions of the importance of management. It is worthwhile taking into consideration following risk management practices that are in accord with the use of the 'precautionary principle' as it has the potential to satisfy the concerns of most stakeholder groups.

The on-ground experiential measure of damage varies between stakeholders. Some TOs and hunters for example, described extensive pig damage when traveling off-trail in bush areas. Farmers based damage estimates on economic costs to farming, and managers based damage estimates on damage found in areas of high pedestrian traffic in protected areas. The observed differences in damage in these various landscapes may have implications for management based on pig spatial movements. It might also be worthwhile to consider the concept of pig buffer zones- transitional zones where pigs thrive which are also boundaries between forest and cultivated or urban landscapes and how that might impact management strategies. There are no spatial studies that provide definitive information about pig movements in these kinds of

transitional zones in the tropics of Australia, though Mitchell et al. (2007) did attempt to incorporate this topic in his examination of pig spatial movements in the Wet Tropics (Campbell and Long 2009; Cowled et al. 2008; Elledge et al. 2008; Hone 1995, 2002). Detailed consideration of buffer zones might create potential opportunities for incentive programs for stakeholders. There is a need for federal management plans that clarify how pig legislation could be applied and of course there is always more room for pig damage studies, but particularly research that strives to operationalize the significance of pig damage to the Australian environment.

Differences in identity frames among stakeholders represent another source of contention. Identity frames describe sense of self and the goal of reframing in this area is not to change self-identity perceptions per se, but might be to expand them. Sense of place is an example. A point of reframing is the consideration that either for personal or professional reasons, all stakeholders have a responsibility to or valuation of, the land on which they live or which they manage. This point might be emphasized for creating more equitable relationships between stakeholders; it can be used to encourage a shared understanding of the pig management issue and assist in moving to more collaborative interactions.

The reframing of whole story and identity frames could assist in improving pig management actions, but it is difficult to make significant suggestions for social adaptations based solely on these two frames. The frames described in this study refer to only individual stakeholder groups. It is also necessary to evaluate group frames; those that attempt to describe the socio-political dynamics between groups (see Chapter 3). Additionally, it would be useful for stakeholders to themselves describe their ideal management strategy as they are the ones involved in on-ground management actions and I am effectively an ‘outsider’ and new to the

problem. Participants have expressed an interest in interacting together. To facilitate stakeholder interaction I will be organizing a search conference for all stakeholders to present their positions and evaluate management strategies on completion of this study.

Ostrom (1990; 2000) suggests communication is crucial to the successful management of common pool resources. I suggest that communication is a key component in pig management that could use re-evaluation. I suggest, from my position of outside researcher, that it may be useful to examine the communication network between these stakeholders and for managers to consider if there is space within their management systems for alternative or additional forms of communication. Also in the realm of communication, just from examining these two types of frames, there may be two main sets of social values and knowledge systems interacting at the nexus of pig control, and it could be valuable to define these and find a common social 'language' so stakeholders are able to better interact and convey their management interests. In addition, trans-boundary water rights literature suggest that apart from improved communication and cooperation in management, cost-sharing and benefit-sharing strategies might contributed to defusing pig management conflict.

There is far more to conflict management than acknowledgement of stakeholder identity frames and whole story frames, particularly when addressing this kind of intractable conflict with its characteristics of long-term disputes and complexity. The understanding of these two frames can, however, provide a foundation from which to begin the process of creating management solutions. Frame analysis as a whole may serve as an ideal method to enable managers to examine the perspectives and relationships of the stakeholders with which they work. This study, which implements only two of the frames employed by Gray (2003), already demonstrates the

value of this strategy for evaluating and reframing the conflict that can be inherent in the management of any natural resource issue.

Literature Cited

Alexiou, P. N. 1983. Effect of feral pigs (Sus scrofa) on sub-alpine vegetation at Smokers Gap, A.C.T. Proceedings of the Ecological Society of Australia **12**:135-142.

Alston, L., B. Mueller, C. Menard, and M. Shirley. 2005. Property Rights and the State Handbook of New Institutional Economics. Pages 573-590. Springer US.

Bateson, G. 1972. Steps toward an ecology of mind. Ballantine New York.

Bauer, C. J. 1997. Bringing Water Markets Down to Earth: The Political Economy of Water Rights in Chile, 1976-95. World Development **25**:639-656.

Bauer, J., and J. Giles. 2002. Recreational Hunting an International Perspective Wildlife Tourism Research Report Series: No. 13: Status Assessment of Wildlife Tourism in Australia Series. CRC for Sustainable Tourism Pty Ltd, Australia.

Benford, R. D., and D. A. Snow. 2000. Framing processes and social movements: an overview and assessment. Annual Review of Sociology **26**:611.

Benford, R. D., and D. A. Snow. 2005. Clarifying the relationship between framing and ideology. Pages 205-211 in H. Johnston, Noakes, John A. , editor. Frames of protest: social movements and the framing perspective. Rowman & Littlefield Publishers, Inc., Oxford, UK.

Bennett, E., A. Neiland, E. Anang, P. Bannerman, A. Atiq Rahman, S. Huq, S. Bhuiya, M. Day, M. Fulford-Gardiner, and W. Clerveaux. 2001. Towards a better understanding of conflict management in tropical fisheries: evidence from Ghana, Bangladesh and the Caribbean. Marine Policy **25**:365-376.

Bennett, L. L., S. E. Ragland, P. Yolles, R. E. Just, and S. Netanyahu. 1998. Facilitating International Agreements Through an Interconnected Game Approach: The Case of River Basins Conflict and Cooperation on Trans-Boundary Water Resources. Pages 61-85. Springer US.

Berkes, F., and C. Folke 2000. Linking Social and Ecological Systems. Cambridge University Press, Cambridge, UK.

Bernard, H. R. 2000. Social Research Methods: Qualitative And Quantitative Approaches. Sage Publications, Inc., Thousand Oaks, CA.

Bernard, H. R. 2006. Research Methods In Anthropology: Qualitative And Quantitative Approaches. AltaMira Press, NY, NY.

Bielsa, J., and R. Duarte. 2001. An Economic Model for Water Allocation in North Eastern Spain. International Journal of Water Resources Development **17**:397-408.

Bomford, M., and J. Caughley 1996. Sustainable Use of Wildlife by Aboriginal Peoples and Torres Strait Islanders. Australian Government Publishing Services, Canberra, ACT.

Booth, W. C., G. G. Colomb, and J. M. Williams 1995. The Craft Of Research. University of Chicago Press, Chicago, IL.

Bourne, L., and D. H. T. Walker. 2005. Visualising and mapping stakeholder influence. Management Decision **43**:649-660.

Bowman, D., and L. Mcdonough. 1991. Feral Pig (*Sus Scrofa*) Rooting in a Monsoon Forest-Wetland Transition, Northern Australia. Wildlife Research **18**:761-765.

Brown, M. G. 1997. The Hunt Down Under. Pine Hill Press, Incorporated.

BSES Ltd. 2012. What we do. BSES Ltd., Indooroopilly, QLD.

Buckles, D., and G. Rusnak. 1999. Conflict and Collaboration in Natural Resource Management. Pages 1-10 in D. Buckles, editor. Cultivating Peace: Conflict and Collaboration in Natural Resource Management. International Development Research Centre & World Bank, ON, Canada.

Butler, J. R. A. 2011. The challenge of knowledge integration in the adaptive co-management of conflicting ecosystem services provided by seals and salmon. Animal Conservation **14**:599-601.

C4. 2012. Community for Coastal and Cassowary Conservation, Mission Beach, QLD.

Calenge, C., D. Maillard, P. Fournier, and C. Fouque. 2004. Efficiency of spreading maize in the garrigues to reduce wild boar (Sus scrofa) damage to Mediterranean vineyards. European Journal of Wildlife Research **50**:112–120.

Campbell, M. C., and J. S. Docherty. 2004. What's in a frame? (that which we call a rose by any other name would smell as sweet). Marquette Law Review **87**:769-781.

Campbell, T. A., and D. B. Long. 2009. Feral swine damage and damage management in forested ecosystems. Forest Ecology and Management **257**:2319-2326.

Canegrowers. 2010. Statistics, Facts and Figures.

Canegrowers Australia. 2010. About Canegrowers. Brightlabs Web Design, QLD.

Cardenas, J.-C., and E. Ostrom. 2004. What do people bring into the game? Experiments in the field about cooperation in the commons. Agricultural Systems **82**:307-326.

CCRC. 2011. Tropical Futures 2016: Pillars For A Sustainable Cassowary Coast. Pages 1-52, Innisfail, Qld.

CCRC. 2012a. Agriculture, Innisfail, QLD

CCRC. 2012b. Our Council, Innisfail, QLD.

CCRC. 2012c. Tourism, Innisfail, QLD.

Choquenot, D., J. Mcllroy, and T. Korn. 1996. Managing Vertebrate Pests: Feral Pigs. . Bureau of Resource Sciences, Canberra, ACT.

Clark, A. 2010. Our business. The State of Queensland, Department of Employment, Economic Development and Innovation, Brisbane, QLD.

Collins, J., N. Klomp, and J. Birckhead. 1996. Aboriginal Use of Wildlife: Past, Present and Future. Pages 14-36 in M. Bomford, and J. Caughley, editors. Sustainable Use of Wildlife by Aboriginal Peoples and Torres Strait Islanders. Australian Government Publishing Services, Canberra, ACT.

Cornwall, A., and R. Jewkes. 1995. What is participatory research? Social Science and Medicine **41**:1667-1676.

Cowled, B. D., J. Aldenhoven, I. O. A. Odeh, T. Garrett, C. Moran, and S. J. Lapidge. 2008. Feral pig population structuring in the rangelands of eastern Australia: applications for designing adaptive management units. Conservation Genetics **9**:211-224.

CPS. 2009. CPS, Tully, QLD.

Cuthbert, R. 2002. The role of introduced mammals and inverse density-dependent predation in the conservation of Hutton's shearwater. Biological Conservation **108**:69–78.

D'Angelo, P. 2002. News Framing as a Multiparadigmatic Research Program: A Response to Entman. Journal of Communication **52**:870-888.

Department of Sustainability, E., Water, Population and Communities 2011. The feral pig (*Sus scrofa*), Canberra, ACT.

DERM. 2010. QPWS 35 years old, Brisbane, QLD.

Dewulf, A., B. Gray, L. Putnam, R. Lewicki, N. Aarts, R. Bouwen, and C. van Woerkum. 2009. Disentangling approaches to framing in conflict and negotiation research: A meta-paradigmatic perspective. Human Relations **62**:155-193.

Dietz, T., E. Ostrom, and P. C. Stern. 2003. The Struggle to Govern the Commons. Science **302**:1907-1912.

Dinar, A., A. Ratner, and D. Yaron. 1992. Evaluating Cooperative Game Theory in water resources. Theory and Decision **32**:1-20.

Dinar, S. 2006. Assessing side-payment and cost-sharing patterns in international water agreements: The geographic and economic connection. Political Geography **25**:412-437.

Diong, C. H. 1982. Population biology andmanagement of the feral pig (Sus scrofa) in Kipahulu Valley, Maui. University of Hawaii, Manoa, Hawaii.

Douglas, L., A. Roberts, and R. Thompson 1988. Oral History: A Handbook. Allen and Unwin Australia Pty Ltd, Sydney, NSW.

Dryzek, J. S. 1997. The Politics of the Earth: Environmental Discourses. Oxford University Press, NY, New York.

Elledge, A. E., I. J. Gordon, C. A. McAlpine, and P. J. Murray. 2008. Pig rooting in lowland rainforests: where, when and what does it do?. Proceedings of the 14th Australasian Vertebrate Pest Conference. . Pages 159-159 14th Australasian Vertebrate Pest Conference, Darwin, Australia.

Entman, R. M. 1993. Framing: toward clarification of a fractured paradigm. Journal of Communication **43**:51-58.

Fisheries, D. o. P. I. 2012. Cassowary Coast Agricultural Activity Profile Summary 2008-2009.

Fordham, D., A. Georges, B. Corey, and B. W. Brook. 2006. Feral pig predation threatens the indigenous harvest and local persistence of snake-necked turtles in northern Australia. Biological Conservation **133**:379-388.

Fordham, D. A., A. Georges, and B. W. Brook. 2007. Demographic response of snake-necked turtles correlates with indigenous harvest and feral pig predation in tropical northern Australia. Journal of Animal Ecology **76**:1231-1243.

Foucault, M. 1972. The archaelogy of knowledge. Routledge, London.

Foucault, M. 1980. Power/Knowledge:selected interviews and other writings by Michel Foucault, 1972-1977. Harvester, Brighton, England.

Furlong, G. T. 2005. The conflict resolution toolbox : models & maps for analyzing, diagnosing, and resolving conflict. John Wiley & Sons Canada, Ltd., Mississauga, Ontario.

Gardner, G. T., and P. C. Stern 2002. Environmental problems and human behavior. Pearson Custom Publishing, Boston, MA.

Gillard, E. 2010. Green Cane Harvesting And Trash Blanketing State of Queensland, Department of Employment, Economic Development and Innovation, Tully, QLD.

Girringun Aboriginal Corporation. 2012. About Us: What is Girringun?, Cardwell, QLD.

Goffman, E. 1959. The presentation of self in everyday life. Doubleday Ancor Books, Garden City, NY.

Goffman, E. 1974. Frame Analysis:An essay on the organization of experience. Harper, New York

Gray, B. 2003. Framing of Environmental Disputes. Pages 11-34 in R. Lewicki, B. Gray, and M. Elliot, editors. Making Sense of Intractable Environmental Conflicts: Concepts and Cases. Island Press, Washington, D.C.

Greenwood, D. J., and M. Levin 1998. Introduction to Action Research: Social Research for Social Change. Sage Publications, Inc., , Thousand Oaks, CA.

Habermas, J. 1984. The theory of communicative action. Heinemann, London.

Habermas, J. 1987. The theory of communicative action. Polity, Cambridge.

Haftendorn, H. 2000. Water and international conflict. Third World Quarterly **21**:51-68.

Hall, S., editor. 1997. Representation: cultural representations and signifying practices. Sage Publications, Ltd., London, UK.

Hanna, S. S., C. Folke, and K.-G. Maler 1996. Rights to Nature: Ecological,Economic, Cultural, and Political Principle of Insitutions for the Environment. Island Press, Washington,DC.

Hanneman, R. A., and M. Riddle. 2005. Introduction to social network methods. University of California, Riverside Riverside, CA.

Hardin, G. 1968. The Tragedy of the Commons. Science **162**:1243-1248.

Hassall and Associates Pty Ltd. 1996. Economic evaluation of the role of bounties in pest management. Vertebrate Pest Program, Bureau of Resource Sciences, Canberra

Helmke, G., and S. Levitsky. 2004. Informal Institutions and Comparative Politics: A Research Agenda. Perspectives On Politics **2**:725-740.

Henzell, T. 2007. Australian agriculture: its history and challenges. CSIRO Publishing, Collingwood, Victoria.

Herr, K., and G. L. Anderson 2005. The action research dissertation: A guide for students and faculty. Sage, Thousand Oaks, CA.

Heylings, P., and F. Cruz. 1998. Common Property, Conflict, and Participatory Management in the Galapagos Islands in IASC, editor. Crossing Boundaries, the Seventh Biennial Conference of the International Association for the Study of Common Property, Vancouver, British Columbia, Canada.

Hillier, K. 2002. Community Based Feral Pig Trapping Program: Review of Program 1993-2002. Department of Natural Resources and Mines, QLD.

Hogarth, M., and P. Allsopp, editors. 2000. Manual Of Cane Growing. BSES, QLD.

Hone, J. 1995. Spatial and Temporal Aspects of Vertebrate Pest Damage with Emphasis on Feral Pigs. Journal of Applied Ecology **32**:311-319.

Hone, J. 1998. Island biogeography theory and feral pig disturbance of grassland. Australasian Wildlife Management Society 11th Annual Meeting. The University of Queensland, Gatton College.

Hone, J. 2002. Feral pigs in Namadgi National Park, Australia: dynamics, impacts and management. Biological Conservation **105**:231-242.

Horsfell, N. 1984. Theorising About Northeast Queensland Prehistory. Pages 164-172. Queensland Archaeological Research Department of Anthropology and Sociology, University of Queensland, St. Lucia, QLD.

Hyams, W., E. Grant, A. Birtles, and P. Valentine. 2007. Finding new meaning for old values: Aboriginal cultural tourism planning in and adjacent to protected areas. Pages 71-94 in D. Smyth, and G. K. Ward, editors. Protecting Country: Indigenous governance and management of protected areas. Australian Institute of Aboriginal and Torres Strait Islander Studies Canberra.

Izac, A. M. N., and P. O'Brien. 1991. Conflict, uncertainty and risk in feral pig management Australian approach. Journal of Environmental Management **32**:1-18.

Johnson, C. N., editor. 2001. Feral Pigs: Pest Status and Prospects for Control. Cooperative Research Centre for Tropical Rainforest Ecology and Management, Cairns, QLD.

Johnston, H., and S. Lio. 1998. Collective behavior and social movements in the postmodern age: Looking backward to look forward. Sociological Perspectives **41**: 453-472.

Johnston, H., and P. E. Oliver. 2005. Breaking the frame. Pages 213-216 in H. Johnston, Noakes, John A. , editor. Frames of protest: social movements and the framing perspective. Rowman & Littlefield Publishers, Inc., Oxford, UK.

Kant, S., and R. Cooke. 1999. Jabalpur District, Madhya Pradesh, India: Minimizing conflict in joint forest management in D. Buckles, editor. Cultivating Peace: Conflict and Collaboration in Natural Resource Management. International Development Research Centre & World Bank, ON, Canada.

Katahira, L. K., P. Finnegan, and C. P. Stone. 1993. Eradicating Feral Pigs in Montane Mesic Habitat at Hawaii Volcanoes National Park. Wildlife Society Bulletin **21**:269-274.

Katz, N., D. Lazer, H. Arrow, and N. Contractor. 2004. Network Theory and Small Groups. Small Group Research **35**:307-332.

Kelman, H. C. 1999. The role of social identity in conflict resolution: Experiences from Israli-Palestinian problem-solving workshops. International Association of Conflict Management, San Sebastian, Spain.

Kliejunas, J. T., and W. H. Ko. 1976. Dispersal of Phytophthora cinnamomi on the island of Hawaii. Phytopathology **66**:457-460.

Laun, C. H. 1971. A Guide to the Removal of Bounties. in R. C. M. W. E. Fund, editor.

Levy, B. S., and V. W. Sidel. Water Rights and Water Fights: Preventing and Resolving Conflicts Before They Boil Over. American Journal of Public Health **101**:778-780.

Lewicki, R., B. Gray, and M. Elliot, editors. 2003. Making Sense of Intractable Environmental Conflicts: Concepts and Cases. Island Press, Washington, D.C.

Lockwood, D. 1963. We, The Aborigines. McPherson's Printing Group, Marleston, SA.

MacGaffey, J. 1991. The Economy Of Zaire: The Contribution Of Smuggling & Other Unofficial Activities To National Wealth. University of Pennsylvania Press, Philadelphia, PA.

Mahjouri, N., and M. Ardestani. Application of cooperative and non-cooperative games in large-scale water quantity and quality management: a case study. Environmental Monitoring and Assessment **172**:157-169.

Mar, J. 2009. About Us. Terrain NRM Ltd, Innisfail, QLD.

Martin, S. 2011. Indigenous Knowledge for Conservation of Natural and Cultural Resources: A Case Study in the
Wet Tropics World Heritage Area of Far North Queensland. College of Agriculture and Life Sciences Cornell University, Ithaca, NY.

Mason, R. J., and P. J. S. Fleming. 1999. Australian hunters and the surveillance of feral pigs for exotic diseases. Wildlife Society Bulletin **27**:395-402.

Masters, K. 1979. Feral pigs in the south-west of Western Australia:Final Report to Feral Pig Committee. Agriculture Protection Board and Department of Conservation and Land Management, Western Australia.

Matthes, J. R. 2009. What's in a frame? A content analysis of media framing studies in the world's leading communication journals, 1990-2005. Journalism & Mass Communication Quarterly **86**:349-367.

McCarty, C., J. Molina, x00E, Luis, C. Aguilar, and L. Rota. 2007. A Comparison of Social Network Mapping and Personal Network Visualization. Field Methods **19**:145-162.

McCay, B. J. 1996. Common and private concerns. Pages 111-126 in S. S. Hanna, C. Folke, and K.-G. Mäler, editors. Rights to nature: ecological, economic, cultural, and political principles of institutions for the environment. Island Press, Washington, D.C.

McGaw, C. C., and J. Mitchell. 1998. Feral Pigs (Sus scrofa) In Queensland in Department Of Natural Resources And Mines, editor. Pest Status Review Series-Land Protection, QLD.

Mcllroy, J. C. 1993. Feral pig Management In The Wet Tropics Of Queensland World Heritage Area. Final Report to the Wet Tropics Management Authority Cairns. CSIRO, Canberra, ACT.

Meier, E. A., P. J. Thorburn, M. K. Wegener, and K. E. Basford. 2006. The availability of nitrogen from sugarcane trashon contrasting soils in the wet tropics of North Queensland. Nutrient Cycling in Agroecosystems **75**:101-114.

Miles, M. B., and A. M. Huberman 1994. Qualitative Data Analysis: An Expanded Sourcebook. SAGE Publications, Inc Thousand Oaks, CA.

Mills, J., Y. Chapman, A. Bonner, and K. Francis. 2007. Grounded theory: a methodological spiral from positivism to postmodernism. Journal of Advanced Nursing **58**:72-79.

Minsky, M. 1975. A framework for representing knowledge. Pages 211–277 in McGraw-Hill, editor. The psychology of computer vision. Winston, P.H., New York.

Mitchell, J., and W. Dorney. 2002. Monitoring Systems for Feral Pigs. Department of Natural Resources and Mines, QLD.

Mitchell, J., W. Dorney, R. Mayer, and J. McIlroy. 2007. Spatial and temporal patterns of feral pig diggings in rainforests of north Queensland. Wildlife Research **34**:597-602.

Moore, C. W. 1996. The Mediation Process: Practical Strategies for Resolving Conflict. Jossey-Bass Publishers, San Francisco.

Morgan, D. L. 1997. Focus Groups As Qualitative Research. Sage Publications, Inc., London.

Noble, K. 1996. Sustainable best practice feral pig management in Queensland wet tropics: Final Report To The Vertebrate Pest Program, Townsville, Australia.

O'Brien, P. H. 1987. Socio-economic and biological impact of the feral pig in New South Wales: An overview and alternative management plan. The Australian Rangeland Journal **9**:96 – 101.

Office of Economic and Statistical Research. 2012. Queensland Regional Profiles Cassowary Coast Regional Council. Pages 1-47. Queensland Regional Profiles. The State of Queensland (Queensland Treasury), QLD.

Office of the Queensland Parliamentary Counsel. 2011. Land Protection (Pest and Stock Route Management) Act 2002, Brisbane, QLD.

Oliver, P. E., and H. Johnston. 2005. What a good idea! Ideologies and frames in social movement research. Pages 185-203 in H. Johnston, Noakes, John A. , editor. Frames of protest: social movements and the framing perspective. Rowman & Littlefield Publishers, Inc., Oxford, UK.

Ostrom, E. 1990. Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press, Cambridge,MA.

Ostrom, E. 1998. A behavioral approach to the rational choice theory of collective action presidential address, American Political Science Association, 1997. The American Political Science Review **92**:1-22.

Ostrom, E. 1999. Coping with tragedies of the commons. Annual Review of Political Science **2**:493.

Ostrom, E. 2000. Collective Action and the Evolution of Social Norms. Journal of Economic Perspectives **14**:137-158.

Pankhurst, C. E., R. C. Magarey, G. R. Stirling, B. L. Blair, M. J. Bell, and A. L. Garside. 2003. Management practices to improve soil health and reduce the effects of detrimental soil biota associated with yield decline of sugarcane in Queensland, Australia. Soil and Tillage Research **72**:125-137.

Parson, T., and E. Shils 1951. Toward A General Theory Of Action. Harvard University Press, MA.

Pedley, H. 2003. My Mission Beach: Timeline, QLD.

Pentecost, P. 2007. Indigenous cultural significance assessment Mission Beach. FNQ NRM Ltd, Tully. QLD.

Pert, P. L. 2012. Wet Tropics Australia. CSIRO, Cairns, QLD.

Portelli, A. 1998. What Makes Oral History Different. Pages 63-74 in R. Perks, and A. Thompson, editors. The Oral History Reader. Routlege, NY.

Postel, S. L., and A. T. Wolf. 2001. Dehydrating Conflict. Foreign Policy **126**:60-67.

Qaddumi, H. 2008. Practical approaches to transboundary water benefit sharing. Overseas Development Institute, London, UK.

Queensland Parliament. 2011. Queensland Parliament, Brisbane, QLD.

Ramirez, R. 1999. Stakeholder Analysis and Conflict Management. Pages 101-121 in D. Buckles, editor. Cultivating Peace: Conflict and Collaboration in Natural Resource Management. International Development Research Centre & World Bank, ON, Canada.

Richards, S. J., K. R. McDonald, and R. A. Alford. 1993. Declines in populations of Australia's endemic tropic frogs. Pacific Conservation Biology **1**:66-77.

Robbins, P. 2004. Political Ecology: A Critical Introduction. Blackwell Publishing Ltd, Madlen, MA.

Roberts, A., R. Aken, T. Chevaton, and J. Chevaton. 1999. Feral pigs: indigenous perspective in C. N. Johnson, editor. Feral Pigs: Pest Status And Prospects For Control, Proceedings Of A Feral Pig Workshop. James Cook University, Cairns, QLD, AUS.

Roberts, A., N. Klomp, and J. Birckhead. 1996. Monitoring marine and terrestrial hunting in an Aboriginal community in North Queensland. Pages 152-168 in M. Bomford, and J. Caughley, editors. Sustainable Use of Wildlife by Aboriginal Peoples and Torres Strait Islanders. Australian Government Publishing Services, Canberra, ACT.

Rolls, E. C. 1969. They All Ran Wild. Angus and Robertson, Sydney, NSW.

Rose, C. M. 1990. Energy and Efficiency in the Realignment of Common-Law Water Rights. The Journal of Legal Studies **19**:261-296.

Rothman, J. 1997. Resolving identity-based conflict in nations, organizations, and communities. Jossey-Bass, San Francisco, CA.

Russell, D., and C. Harshbarger 2003. Groundwork For Community-Based Conservation: Strategies For Social Research. Altamira Press, , Walnut Creek, CA.

Rydin, Y. 2003. Conflict, Consensus, And Rationality In Environmental Planning: An Institutional Discourse Approach. Oxford University Press, New York.

Sandell, G., and J. Agnew, editors. 2002. Harvesting Best Practice Manual. BSES, QLD.

Scheff, T. J. 2005. The Structure of Context: Deciphering Frame Analysis. Sociological Theory **23**:368-385.

Schon, D. A., and M. Rein 1994. Frame Refelection. Basic Books, New York, NY.

Sharp, R., and K.-U. Wollscheid. 2009. An Overview of Recreational Hunting in North America, Europe and Australia. Pages 25-38. Recreational Hunting, Conservation and Rural Livelihoods. Wiley-Blackwell.

Shriver, T. E., and C. Peaden. 2009. Frame Disputes in a Natural Resource Controversy: The Case of the Arbuckle Simpson Aquifer in South-Central Oklahoma. Society & Natural Resources **22**:143-157.

Simmons, A. 1993. A Preliminary Aboriginal Cultural Heritage Survey of the Wet Tropics World Heritage Area, Innisfail District, Innisfail, QLD.

Smith, M. J. 1990. The role of bounties in pest management with specific reference to state dingo control programs. Charles Stuart University, NSW.

Sommer, B., and M. Quinlan 2002. The Oral History Manual. Altamira Press, CA.

Statham, M., and M. Middleton. 1987. Feral pigs on Flinders Island. Pages 121–124 Papers and P roceedings of the Royal Society of Tasmania Tasmania.

Steins, N. A., and V. M. Edwards. 1999. Platforms for collective action in multiple-use common-pool resources. . Agriculture and Human Values **16**:241–255.

Strauss, A., and J. Corwin 1990. Basics Of Qualitative Research: Grounded Theory Procedures And Techniques. Sage Publications, Inc., Newbury Park, CA.

Takahashi, S., and C. A. Tisdell. 1989. The trade in wildlife pig meat; Australia and Japan. The Australian Geographer **20**:88-94.

Thompson PM, M. B., Barton TM, Duck C, Butler JRA. 2007. Assessing the potential impact of salmon fisheries management on the conservation status of harbour seals (Phoca vitulina) in north-east Scotland. Animal Conservation **10**:48–56.

Tisdell, C. A. 1982. Wild Pigs: Environmental Pest or Economic Resource? . Pergamon Press Sydney.

Tomlinson, A. R. 1957. Bonuses for vermin control Conference on Vermin Control Agriculture Protection Board, Perth, W.A.

Tully Sugar Ltd. 2012. Welcome to Tully Sugar Limited, Tully, QLD.

Wang, L., L. Fang, and K. W. Hipel. 2008. Basin-wide cooperative water resources allocation. European Journal of Operational Research **190**:798-817.

Warner, J., and A. van Buuren. 2009. Multi-Stakeholder Learning and Fighting on the River Scheldt. International Negotiation **14**:419-440.

Wasserman, S., and K. Faust 2007. Social Network Analysis: Methods and Applications. Cambridge University Press, NY,NY.

Watson, J. 1993. Becoming bwgcolman exile and survival on palm island reserve, 1918 to the present. Department of History. University of Queensland, Brisbane,QLD.

WETMA. 2010. About the Wet Tropics Management Authority, Cairns, QLD.

Wondolleck, J. M., B. Gray, and T. Bryan. 2003. Us versus Them: How Identities and Characterizations Influence Conflict. Environmental Practice **5**:207-213.

Wondolleck, J. M., and S. L. Yaffee 2000. Making Collaboration Work: Lessons from Innovation in Natural Resource Management. Island Press Washington,DC.

Young, J., J. Butler, A. Jordan, and A. Watt. 2012. Less government intervention in biodiversity management: risks and opportunities. Biodiversity and Conservation **21**:1095-1100.

Young, O. R., F. Berkhout, G. C. Gallopin, M. A. Janssen, E. Ostrom, and S. van der Leeuw. 2006. The globalization of socio-ecological systems: An agenda for scientific research. Global Environmental Change **16**:304-316.

Yow, V. 1994. Recording Oral History: A Practical Guide for Social Scientists. Sage Publications, Inc., CA.

Zivin, J., B. M. Hueth, and D. Zilberman. 2000. Managing a Multiple-Use Resource: The Case of Feral Pig Management in California Rangeland. Journal of Environmental Economics and Management **39**:189-204.

Chapter 3

The Impact Of Social Structure On Intractable Conflicts: The Socio-Politics Of Feral-Pig Management in Far North Queensland

Introduction

Intractable conflicts are hard to manage, complex, messy, intense, and frustrating. These types of conflicts represent long-term issues of contention that, despite efforts, fail to be readily resolved (Lewicki et al. 2003; Schon and Rein 1994). In the realm of natural resources, intractable conflict can be found, for example, in wildlife management such as the long-term management challenges of regulating harbor seal populations in the Moray Firth, northeast Scotland or in the management of forest resources in the Jabalpur District, Madha Pradesh, India (Butler 2011; Kant and Cooke 1999; Thompson PM 2007; Wolf 1998; Young et al. 2012).

One of the factors that impact the nature of conflict is the presence of multiple stakeholders. Multiple use resources are those used by individual or multiple user groups and for which a principle of subtractability exists (Steins and Edwards 1999). Subtractability occurs when the use of the resource by one individual or group reduces the potential for that resource to be used by others (Ostrom 1990). For example, salmon fishers in Moray Firth in northeast Scotland contend that seals have a significant economic impact on salmon fishing activities. Seals hunt the fish in and around netting stations and interfere with angling activities, causing damage to coastal nets. In response, fishers legally shot seals near coastal haul out sites (Butler 2011; Thompson PM 2007; Young et al. 2012). According to wildlife tourism operators and conservation groups, these actions endanger local seal populations and interfere with the general interests of these user groups. Butler (2011) contends that the conflict arises in part from the top

down structure of management actions in which key stakeholders, such as the fishers, are not incorporated into management practices. This is an on-going conflict exacerbated by the diversity of stakeholder perceptions, but also the ways in which stakeholders are incorporated into the management process.

As in the case of the seals in Moray Firth, dissention between multiple stakeholder groups over the management of forests in Jabalpur district Madhya Pradesh, India led to conflict. The expansion in the 1970's of Jabalpur, a major city in Madhya Pradesh, resulted in an increased demand for lumber. Although the state forest department offered sustainably logged timber, timber traders chose to primarily harvest lumber illegally, because it was far cheaper. This resulted in forest degradation and deforestation and led to conflict amongst local tribes and village residents, all of whom, valued the forest resource differently (Kant and Cooke 1999). The conflict reached its climax after a major forest fire in 1989. Eventually, in 1995, state forest officers established an initiative that represented all stakeholders except the timber traders (who were not local) in order to address stakeholder concerns and improve forest management. Forest monitoring was placed under the control of local stakeholders. Thus far, this program has been more effective in managing forest use (Kant and Cooke 1999). Ultimately, the conflict resulting from competition between the stakeholders was only resolved through the cooperation of the state officials and local resource users.

Political institutions that fail to recognize the multiple interests of resource users may lose their legitimacy in the eyes of stakeholders whose needs are not met (Ostrom 1990; Steins and Edwards 1999). This can lead to habitual use of the resource by stakeholders in ways that ignore legislation and in turn policy goals will not be satisfied. Meanwhile, policy that does consider the dynamic nature of a resource and is adapted to address stakeholder concerns may

provide long-term management solutions (O'Brien 1987). This study uses the case of feral pig management to explore how socio-political relationships influence the management of multiple use resources in the presence of intractable conflict.

Feral pigs represent a multiple use resource whose management is fraught with conflict (Roberts et al. 1996). The present study examines feral pig management in the Cassowary Coast Regional Council (CCRC) of Far North Queensland. The Wet Tropics bioregion of Far North Queensland (FNQ) is estimated to hold up to 75% of Queensland's pig populations largely because their needs for a regular source of water and habitat cover are easily met (McGaw and Mitchell 1998). In Australia, there is a large and heterogeneous group of stakeholders interested in their management. The intent of this paper is to examine socio-political relationships between multiple stakeholder groups with a focus on some primary stakeholders in this region: farmers, pig hunters, and also traditional land owners and managers. This study uses the Gray (2003) method of frame analysis for environmental disputes, because it can provide an arena in which to evaluate the components of complex environmental management issues. Through this examination, it is possible to both better understand the impact of stakeholder relationships on the management of natural resources in conflict, and to explore strategies for reframing contentious issues in order to encourage more positive management outcomes.

Literature Review

Stakeholders And Feral Pig Management

Feral pigs have diverse global impacts on wildlife and plant ecology, as well as economic, health, and social sectors. Some stakeholders consider pigs a valuable resource while others feel pigs should be eradicated. For example, in Hawaii, multiple stakeholders contended

over the use of pigs (Maguire 2004). Protected area and exotic animal control managers strove to reduce pig populations because of the damage they were perceived to cause to wildlife and habitat. Meanwhile, native Hawaiians consider the hunting and consumption of pigs to be an important cultural tradition and wish to maintain sufficient pig populations for these activities. State managers of game lands try to control pig populations rather than destroy them. Animal rights advocates are concerned with some of the methods used to capture and kill pigs.

A survey of the lifestyles and attitudes of pig hunters in Greece described hunting as a leisure activity that could be used to supplement dietary intake and appeared to be conducted by middle class, middle income Greeks (Tsachalidis and Hadjisterkotis 2008). Hunter practices are considered by the government to be essential to controlling pig populations due to the perceived damage they cause, particularly to agriculture (Tisdell 1982; Tsachalidis and Hadjisterkotis 2008).

Pigs are known to be a critical part of Papua New Guinea culture; they are used as bridal gifts, at initiation ceremonies, and other rituals. Feral pig stocks are domesticated, or hunted outright. When domesticated, they are meticulously cared for before being used for food or rituals. These populations are carefully managed to prevent extinction (Dwyer 2006; Hide 2003). In a study of the importance of pig herding and ritual to socio-political power in New Guinea, with a focus on gender based power, Sillitoe (2001) found that while it was typically understood that men gained and maintained power by using pigs for ritual purpose, women also held a certain amount of power as the result of herding these animals. Also, because of their perceived cultural and dietary value, pigs were carefully managed; there were only 2 to 3 intact male pigs kept in each village studied to maintain pig numbers and quality.

Adams (2005) examined the views of managers and landowners, including farmers, with regard to pig management in several ecoregions of Texas, USA. All stakeholders were in agreement that pigs caused significant damage and both groups undertook management actions. Some of the landowners, who were also self-declared recreational hunters, gained income from pig hunting. There was some confusion on the part of landholders about which governing body to address about feral pig concerns, because there was no unified governing body in charge of pig control.

Feral pigs have become an increasingly important management issue in Australia. Today there may be as many as 23.5 million pigs inhabiting approximately half of Australia (Department of Sustainability 2011). Few Australian studies of feral pig management have examined socio-political relationships in detail. In a review of US, European, and Australian hunter practices, Bauer and Giles (2002) found strained interactions between some managers and hunters in Australia and describe the differences between these parties only as being 'ideological'. Noble (1996) examined a community trapping program organized in Far North Queensland and found that farmers were dissatisfied with the way some of the officials ran the program. This study recommended further investigation of the human dimension of management because of the challenges caused by the exclusion of some community stakeholders during the project process. A review of Australian pig control legislation by Izac and O'Brien (1991) similarly showed that the lack of clarity, the large variability of pig management policies, and the exclusion of community views could lead to conflict among the different actors involved with pigs.

Pigs As A Common Pool Resource: Power, Knowledge And Communication

One important consideration for the management of feral pigs is the role of pigs as a common pool resource. This can be defined as a multiple-use resource that is of such a large scale that it is costly or difficult to restrict access to beneficiaries (Dietz et al. 2003; Ostrom 1990, 1999). Hardin (1968) suggests that in such situations, the drive for individuals to act for their own benefit will, unchecked, ultimately destroy the resource in question. According to Hardin, this process can be sustainable when populations are limited, but when populations are large, this scenario leads to a "tragedy of the commons" situation. Hardin's model, however, assumes that each stakeholder works in a vacuum; that s/he is completely unaware of and acts completely independently of the actions and attitudes of all other stakeholders. This model also assumes that cultural norms do not influence the decision-making process. When these conditions are met, Hardin's model may be valid. For example, this model is accurate when stakeholder behavior goes unnoticed (neither penalized nor rewarded) or when communication systems break down (Cardenas and Ostrom 2004; Dietz et al. 2003; Ostrom 2000).

Ostrom (1990) used game theory, experimentation, and comparison to field studies of socio-ecological systems to demonstrate that when communication is allowed between stakeholders, resources can be removed from the resource system at an ideal rate that prevents the destruction of the resource (Ostrom 2000; Steins and Edwards 1999). Ostrom (1998, 1999, 2000) described communication as essential for the successful management of common pool resources. The theory of communicative action describes communication as being essential for the success of formal institutions (Habermas 1984, 1987; Helmke and Levitsky 2004; Rydin 2003). Language, the origin of most kinds of communication, is a complex structure. Habermas (1984) describes language as consisting of 'speech acts'. Speech serves to maintain and establish

interpersonal relationships, to represent "events and states" and represent one's own self. Therefore, for successful management interactions, it is not just the presence of communication that is needed; it is also essential to have the ability to understand the intention of the language used (Habermas 1987; Rydin 2003).

The resource systems in which common pool resources are used are not spontaneously forming entities that are a product of the environment; rather, they are a social construct. They are the product of community consideration, public choice, and agreement (McCay 1996). To appropriately manage a resource, it is thus necessary to create management practices that consider how local stakeholder values, concerns, and knowledge and occur in a realm that includes a functional communication network. In this way, management strategies can be created from a more complete knowledge base in which there is accurate knowledge both about the resource and resource users. It requires the partnership of biological, economic, and socio-political aspects of management (McCay 1996; Ostrom 1998, 1999).

Socio-politics describes social and informal and formal political relationships of a system (Morgan et al. 2004). One of the challenges of evaluating socio-political relationships is working with multiple stakeholder groups who have diverse sets of management values. Chapter 2 described the beliefs and values of stakeholders in CCRC in regards to pig control in detail. Multiple value systems are at play among the various community stakeholder and manager groups, which at the interface of feral pig management can lead to points of both conflict and consensus. The problem is that each of these stakeholder groups is unclear about the value systems of the others. The points of consensus that can be used to launch meaningful dialogue and assist in the negotiation process are lost or misunderstood, as are points of conflict. The

examination of socio-politics can provide insight into the impact of this kind of discord on pig management actions.

Socio-political studies provide essential knowledge about resource use, but they also provide invaluable information about local stakeholder interests and about how they act. All people have deeply held beliefs and values, but they do not necessarily always act on these beliefs and values (Gardner and Stern 2002b; Goffman 1959; Russell and Harshbarger 2003). The power inherent in socio-political subsystems is a major influence on how people act. Foucault suggests that power is not about discerning who holds it; it is the historical context of power that helps us to define it (Dreyfus et al. 1983; Foucault 1980). He suggests that definitions of power are derived from our history (Foucault 1980). Historical processes- events, discourse, the use and abuse of knowledge- all serve to provide the cultural background and concepts that inform modern definition of power and its uses. Conceptualizations of power are based on our own perceptions of ourselves and our beliefs about the kind of power we and others hold, coupled with our understanding of the meaning of power (Forgas and Williams 2001). Power and knowledge are inexorably connected, so that power may be derived from learning, but knowledge, the accepted truths of a society, may be generated by power. This provides the notion that there can be no one truth, only truth imbedded within the relative perimeter of a particular society. Similarly, perceptions of power are influenced by relative parameters. Power "is relational; it becomes apparent when it is exercised" (Foucault 1980; Townley 1993). Therefore, one way to study power is to examine people's perceptions of power (Forgas and Williams 2001).

Politics refers to the allocation of values by authority figures, decision-making processes and the use of power to enforce authorized goals and values (Firey 1960). The political arena

associated with feral pig use sets the laws for its control. This arena also defines formal and informal power and authority structures within the resource system. The laws governing pig use are more evident than the political structures of pig resource use.

In Australia, because pigs are not a protected species anyone can hunt the species outside of national parks and reserves (Takahashi and Tisdell 1989). What is apparent about political structures from the literature is that with only a few exceptions, feral pig management policy is created and controlled or jointly managed, by federal, state, for-profit and non-profit institutions. These institutions traditionally appear to receive little input from local stakeholders who are also concerned about the resource (e.g., recreation, commercial, and subsistence hunters; Bomford and Caughley 1996; O'Brien 1987).

This study employs frame analysis to examine the socio-political relationships among stakeholder groups as they function within the feral pig resource system. It provides insight into the micro-dimensions of power in which stakeholders are involved and where individuals may hold diverse levels of influence and power depending on the groups with whom they interact. This project acknowledges that participants may have multi-dimensional power roles (Mosse 2004). The examination of these relationships also provides insights into the influence of multiple knowledge systems, relationships to resources, group social structure, stereotypes, and communicative interactions on pig management interactions. It provides insight into the social barriers that can turn an already complex management issue into an intractable one. It also provides new pathways of understanding that can suggest ways in which to address complex management issues. One strategy for the evaluation of stakeholder relationships is through the use of frame analysis.

Frame Analysis

Discourse theory is widely used to examine the communication that occurs among stakeholders. Discourse is about the creation of knowledge through language and practice. It defines the way a subject is evaluated and discussed (Foucault 1972, 1980; Hall 1997). There are multiple discourse strategies that can be applied to the analysis of common pool resource systems. Framing analysis is one such type of discourse analysis (Rydin 2003; Schon and Rein 1994). The essential purpose of frame analysis is to describe the context for the discourse occurring between stakeholders. Frame analysis examines the attributes of the lenses through which stakeholders perceive and interpret new events or scenarios with which they are confronted (D'Angelo 2002; Entman 1993; Scheff 2005).

There has been much critical debate surrounding frame analysis; much of the criticism is centered on the lack of a clear operational definition of the terms frame and framing (for a review, see D'Angelo 2002; Entman 1993; Scheff 2005). Dewulf et al. (2009) most recently addressed this debate by arguing that rather than one uniform method to define and investigate frames or framing, a multiple paradigm approach is most beneficial. The authors describe two different frame analysis paradigms: interactional and cognitive. The interactional paradigm focuses on analyzing the framing process. Framing processes describe how stakeholders come to develop particular frames, and how and why frames change (Bateson 1972; Benford and Snow 2000). Frames are transient entities that continually change; the information that feeds frames grows and changes in every interaction among stakeholders (Dewulf et al. 2009). Unlike the interactional paradigm, the cognitive paradigm examines and defines particular frames at a particular moment in time rather than examining how the framing process occurs and changes.

The objective of the cognitive paradigm is to examine the frames themselves (Dewulf et al. 2009; Oliver and Johnston 2005).

This study applies the cognitive paradigm to examine feral pig management. The basis of the cognitive frame is rooted in the work of Minsky (1975), who defined a frame as a "data structure for representing a …situation." He described the foundation of frames as being in the memory; a frame behaves as a "remembered framework to be adapted to fit reality by changing details as necessary." People draw upon these frames when presented with a new event or scenario. While a frame can be considered relatively constant over some period of time, it can change as the individual changes (Dewulf et al. 2009; Scheff 2005). Frames are fed by both internal and external influences, and they are developed with both conscious and subconscious input (Benford and Snow 2000; Benford and Snow 2005; Dewulf et al. 2009; Johnston and Lio 1998; Johnston and Oliver 2005; Matthes 2009; Oliver and Johnston 2005; Scheff 2005). Stakeholders apply multiple frames to every scenario, which Minsky (1975) refers to as 'frame systems'. The beauty of frame analysis is that it can be used not only to examine intractable conflicts, but also to determine arenas for reframing conflict to begin to develop management solutions. Reframing is the process of reinterpreting issues or reappraising other stakeholders or their values. The purpose of reframing is to help facilitate the process of moving from conflict to collaboration. Reframing does not always guarantee the resolution of conflict, but it does offer the potential to facilitate or defuse some aspects (Lewicki et al. 2003; Schon and Rein 1994; Shriver and Peaden 2009).

This study examines some of the features that make feral pig management in the CCRC of FNQ an intractable conflict and provides suggestions for using collaborative methods to defuse conflict and create more effective management outcomes. In this study, I employed three

types of frames to describe socio-political relationships among stakeholders: 'characterization', 'power frames', and 'social control frames'. I also examined identity threats.

Characterization frames describe a participant's perception of other stakeholders (Gray 2003). I also inquired about how the stakeholder believes he is perceived by others. I focused on stereotypes, or characterizations of stakeholders that are overly simplified generalizations, because they contribute to conflict. Stereotypes are created based on contact with other stakeholders or on information provided by fellow community members or through media (Abreu 2001; Lippman 1921). These beliefs lack flexibility; even in the face of contrary evidence, they will still, most likely, be considered true (Rothbart 1981).

The power frames used in this study were adopted from the power frames uncovered by Gray (2003) while using grounded theory when interviewing stakeholders over a dispute (Table 1). Gray's frames of power are descriptions of relational power that became apparent when the frames were exercised during a study of environmental conflict (Foucault 1980; Gray 2003; Townley 1993). These power frames represent stakeholders perceptions of power; perceptions of the kind of power we and others hold (Forgas and Williams 2001). Some of these same power frames were used during the course of this study. Authority/positional power is particularly important, because those who hold it have the distinct ability to determine which knowledge and value systems are used to define truths and to make formal management decisions (Foucault 1972, 1980; Rabinow 1984; Townley 1993). Personal power is determined by social capital (Table 1); those with stronger social capital have greater personal power. Social capital refers to capital built on reputation and social status and determined through interpersonal relationships (MacGaffey and Bazenguissa-Ganga 2000). Social capital is described as a key element for a

functional social system and provides legitimacy to the system (Habermas 1975; Parsons 1968). Strong social capital provides validity to pig management beliefs and values.

Table 1. Descriptions of Power Frames. Adapted from Gray (2003).

Frame	Meaning
Authority/Positional	The power of an individual to make decisions about management and cause them to be enacted based on his formal position of employment or role within an organization.
Resource	This is derived from control of possessions that facilitate pig management actions.
Expertise	This type of power is ascribed to a stakeholder in possession of special unique knowledge or experience not held by others.
Personal	Based on social capital.
Coalitional/Relational	The power associated with group membership when members support shared perspectives.
Sympathy/ Vulnerability	This is derived from holding the role of 'the victim' and tends to be emotionally supported by others.
Force/Threat	Refers to the use or threat of coercive actions.
Moral/Righteous	Attributed to being ethically or morally correct.
Voice	The ability to have your views heard by the wider community.

Social control frames are stakeholder perspectives about how feral pig management decisions should be made. Social control frames are dependent on two criteria: 1) the level of stakeholder interdependence in management decision-making and 2) the amount of ownership stakeholders' should have over the management process. Differences in practice and opinion about ownership and dependence can lead to conflict between stakeholders and can lead to the failure to complete management goals and actions (Lewicki et al. 2003). Identity threats are

attacks to a stakeholder's sense of identity (referred to by Gray as the 'identity frame') as a whole (Gray 2003). They are a threat to core values and beliefs and have the potential to elicit a profound emotional charge (Wondolleck et al. 2003). This kind of attack can lead to the disintegration of relationships between key stakeholders, can lead to conflict, and can cause loss of legitimacy within a system.

Methods

This study represents part of a larger action research (AR) study that began in 2007 (Chapter 1). I and other relevant stakeholders worked together to develop the research questions, design, and conduct the study, and disseminate information. This form of research requires constant evaluation, feedback, and cycles of reflection to help assure that the principles of AR are maintained and AR has a practical action as a result (Greenwood and Levin 1998; Herr and Anderson 2005; Portelli 1998; Russell and Harshbarger 2003). The study was designed in conjunction with hunters and growers, and had some input from traditional land owners (TOs). The study goals, data collection methods, interview guides, and participants were selected with the assistance of hunters and farmers. TOs assisted with participant selection, but were incorporated into the study later; three of the five TOs were incorporated into the study early enough to have some input into the data collection methods. All TOs were asked for feedback about the study goals, data collection methods and interview guide regardless of when they joined the study. Data were collected using oral history and individual interviews, participant observation, and sociograms. Data analysis was based on a grounded theory approach and themes derived from the grounded theory processes were further evaluated using a cognitive paradigm of frame analysis.

The study was conducted in the Cassowary Coast Regional Council (CCRC) area in the Wet Tropics of Northern Queensland between 2007 and 2009. The CCRC area covers 4,700 km^2. The limits of this region include the town of Garradunga to the north, Cardwell to the south, East Palmerston to the west, and the most eastern boundary is not marked by a particular town, but more by a complex of islands and reefs that make up part of the Great Barrier Reef Marine Park. The region consists of approximately 31,291 persons over a region of 4,700.0 km^2. The official language is English, but there are a number of indigenous dialects spoken and because there is a significant migrant history, 48 languages are used in the region (CCRC 2011; Girringun Aboriginal Corporation 2012; Henzell 2007; Simmons 1993).

A total of 52 collaborators were interviewed for this study (Table 2). Oral histories were conducted with the principle collaborators: the 15 hunters and 15 farmers. In addition, I observed that traditional land owners, a key group, were missing. Thus, oral histories were also conducted with individual representatives of each of 4 mainland TO groups of the CCRC area: Djiru, Girramay, Jirrbal, and Ma:Mu. An additional TO was interviewed who was unable to identify his TO ancestry. Individual interviews were conducted with the remaining 17 participants. The two principle collaborator groups referred these participants to me.

The last category of participants, referred to simply as 'managers,' included several types of environmental and agricultural managers, government, and commercial representatives (Table 2). Environmental managers work for public or non-profit organizations concerned with the management of public lands. I also included a CCRC council representative (CCRC Rep) because this stakeholder is a land manager responsible for on-ground management of council lands. Agricultural managers are part of both for-profit and non-profit organizations with

interests in the agricultural sector. There is additionally one state government representative, one other CCRC representative, and the commercial representative is a local contractor.

Data collected in the form of participant observation included informal feedback from multiple other CCRC residents. The Tully Bow Hunters Club, the Kurrimine Bow Hunters Club, and the Queensland branch of the Sporting Shooters' Association of Australia assisted with this study. Staff from the Commonwealth Scientific and Industrial Research Organisation and Terrain Natural Resource Management, who sponsored the study and contracts Boar Busters, also participated.

Table 2. Description of the collaborators who participated in the interview process. This table includes information about the interview types used, collaborator identity, type, and the number of participants in the study.

Interview Type	Identity	Type	Number of Participants
Oral History	**Farmer**	Cane	5
		Banana	5
		Tropical Fruit	3
		Grazier	1
		Plantation	1
		Total	15
	Hunter	Bow Hunter	5
		Pig Dogger	5
		Rifle Hunter	3
		Prof Trapper	1
		Prof Chiller Box Hunter	1
		Total	15
	Traditional Owners	Djiru	1
		Girramay	1
		Jirrbal	1
		Ma:Mu	1
		Other	1
		Total	5
Individual Interviews	**Managers-Environmental**	Wet Tropics Management Authority	1
		Department of Primary Industries and Fisheries	1
		Terrain Natural Resource Management	2
		Queensland Parks and Wildlife Service	4
		Communities for Cassowary and Coastal Conservation	2
		CCRC Council Representative	1
	Agricultural	Tully Cane Productivity Services, Ltd	1
		Canegrowers Australia	1
		Tully Sugar Mill (Tully Sugar, Ltd)	1
		Total	14
		State Government Representative and CCRC Council Representative 2	2
	Commercial	Boar Busters	1
		Total	3

Data Collection

Planning And Group Meetings

Planning meetings were held separately with farmers and hunters at the beginning of the study to organize the research process. Planning meetings were later held with TOs. Group meetings were held with these stakeholders throughout the research process in order to reflect upon and revise the research process.

Oral History

Participants suggested that I use oral histories as the principal interview method. Oral histories are a kind of individual interview that provides one person's viewpoint of events (Portelli 1998). The interviewee is the main speaker who leads the description of events, people, places, and stories. The interviewee in an oral history is sometimes referred to as a narrator for this reason. The role of the interviewer is to help guide the interview. The interviewer helps to keep the interview from straying off the topic. He or she helps ask questions to probe, explore, and clarify the depths of the story being unraveled (Sommer and Quinlan 2002).

The type of oral histories recorded here are single-issue interviews. These histories provide detailed information and insight into one particular subject (Douglas et al. 1988). I used single issue interviews to review a participant's history in relation to pigs. This method was used to interview all hunters, farmers, and TOs. I held one or two sessions with each participant over a maximum of about 2 hours. Collaborating hunters, farmers, traditional owners and I created an interview guide to direct these interviews. The purpose of the guide was to act as a flexible plan for the interview; it included important topics, but specific questions and the exact phrasing could change depending on the direction taken by the narrator (Yow 1994). Answers to these

questions might be provided by the narrator without prompting while he presented his narrative about pig management.

Individual Interviews

I also conducted individual interviews which hunters, farmers, and TOs considered important to feral pig management. Interviews were presented in a semi-structured format (Bernard 2000, 2006; Booth et al. 1995; Morgan 1997). These interviews, as opposed to oral histories, were interviewer led and addressed specific topics included in the format, although some flexibility remained in the direction and ways these topics are addressed (Bernard 2000, 2006).

Participant Observation

I used this method to examine day to day activities considered important to understanding a research question. The researcher participates in some event or looks at a place to experience what it is like and why it is important (Bernard 2000). In this case, study participants requested that I observe and experience firsthand incidences of pig activity and damage, hunting, and any other events that participants considered relevant. I resided in the CCRC area for the duration of the study. I participated in site visits to examine pig damage on farming properties, and in protected areas. I participated in hunting trips, joined the Tully Bow Hunters Club, and attended the Kurrimine Bow Hunters Club. I participated in community events and attended pig related activities that were open to the public such as pig weighing competitions. I also studied photographs of pig damage, hunting, and video footage of pig hunts. In addition, I examined the local paper, the *Tully Times* and pig hunting magazines.

Participatory Sociograms

Sociograms are visual representations of stakeholder relationships. They depict with whom stakeholders have relationships and provide information on the kinds of relationships (e.g., positive or negative) they represent. Sociograms include relevant nodes and ties (Katz et al. 2004) . Nodes are points that represent each stakeholder while ties are lines that describe the relationships. For example a one way line with an arrow may describe a relationship where one stakeholder provides information to another (Katz et al. 2004; Wasserman and Faust 2007). The sociograms used in this study represent 'ego-centric' networks. They describe only the direct relationships between the focus stakeholder and other stakeholders (Bourne and Walker 2005; Hanneman and Riddle 2005; Katz et al. 2004; McCarty et al. 2007; Wasserman and Faust 2007). Sociograms used in this study depict the social landscape as perceived by stakeholders. These 'social maps' represented the landscape of the feral pig resource system through diagrams created by participants that described the socio-political relationships between hunters, farmers and other stakeholders.

I conducted individual sociogram-making sessions with all the participants I interviewed. During a sociogram session, participants were given the option of creating sociograms with markers, pencil, or pen on paper. The purpose of making the maps is to investigate how stakeholders perceive they are connected to other participants associated with feral pig management. A participant depicts himself by placing an oval with his name at the map's center. Other stakeholder ovals circle this center oval as indicated by the participant's placement of them. The types of ties between participants used here are adapted from Wasserman and Faust (2007) and provide information about the charge of the relationship (positive or negative), the directionality of the relationship (which individual shares information with whom), and

relationship type, and whether relationships are mutual (information or resource sharing) or unidirectional (e.g., one person provides information to another without reciprocation).

Data Analysis

I indexed all the data collected, including oral histories, interviews, participant observation, sociograms, and notes derived from all research activities using mnemonic codes. The code names were derived directly from concepts in the study (i.e., SOC for social, PIG for feral pig; Bernard 2006; Miles and Huberman 1994). These codes were used with date, note number (consecutive identification of notes and interviews), and delimiter codes (these codes help a computer to identify the beginning and end of each item) to quickly identify and locate notes, interview transcripts, etc. about specific topics (Miles and Huberman 1994). I used the qualitative data analysis computer software package NVivo to analyses the collected data (Miles and Huberman 1994).

I analyzed the data using qualitative methods. I used grounded theory to categorize and derive concepts from texts and to link these concepts into substantive and formal theories (Strauss and Corwin 1990). Codes and major themes describing the perspectives of hunters and farmers regarding feral pig management were derived directly from analyses of transcripts and photos. Codes were inductive, meaning that they were not conceived prior to data analysis. I used a process of triangulation to compare the results found in the interviews, discussion groups, sociograms, and participant observation. The codes and major themes that evolved from the grounded theory process were used to create a basic theory about the results. Aspects of this theory were described using frame analysis (Mills et al. 2007; Rydin 2003).

I examined the data resulting from the sociograms using a matrix to compare stakeholders (row labels) with the kind of relationships (column labels) they had with other

stakeholders. The relationship columns used a three point description- positive/strong relationship, intermediate relationship, negative/weak or no relationship. A strong relationship was one in which stakeholders shared the most ties and a weak relationship was one in which stakeholders shared the fewest ties. A positive relationship occurred when stakeholders were happy with their connection with others and shared satisfying exchanges. An intermediate relationship was one in which there was a mix of positive and negative exchange or where a relationship was simply equitable. A negative exchange occurred when stakeholders felt a deep dissatisfaction with the communication with others. No relationship describes the case when there is no exchange between stakeholders. Stakeholders are aware that these other participants are involved or should be involved in pig management in some way, but they share no personal ties to them.

I based the matrix data analysis on the results of the maps and also participants' responses to questions about these maps and their descriptions of other stakeholders in interviews. For example, a stakeholder might describe 'no relationship' as being negative, because no relationship exists where there should be one. An 'intermediate relationship' could be intermediate for a number of reasons. For example, it could be intermediate because a stakeholder shared positive information with another stakeholder and received negative feedback. It could be intermediate because these two groups shared some regular exchanges that were said to contain both positive and negative moments. It could be intermediate because there was some regular exchange, but this exchange was not charged- for example a hunter might pay x dollars to a shop owner to buy hunting equipment and receive the equipment with payment.

Results

The relationships between stakeholders and their use of the feral pig resources is complex. I examined the connection and level of importance of the feral pig resource to stakeholders. I identified the knowledge systems that influence and are influenced by these perceptions, as well as information about characterization frames, power frames, social control frames and identity threats. Six types of power frames appeared in the feral pig management conflict. The types of power described by these frames are: authority, resource, expertise, personal, coalitional, and voice.

Connection To Resource

The relationship of individuals in each stakeholder group to feral pigs is described in Table 3. Hunters, farmers, and TOs who are hunters have the closest relationship with the feral pig resource: they see and/or hunt pigs regularly. Environmental and agricultural managers generally have an intermediate to low relationship with pigs. They conduct some pig control or research, but other types of management activities play a more significant role in their daily routines. The one exception is one environmental manager whose profession requires regular contact with pigs. Government officials have a low connection to the pig resource with little to no contact with pigs.

Table 3. Power and knowledge systems within the feral pig resource system in CCRC Queensland, Australia. This table describes authority power (the ability to enact management changes in the system), the connection each stakeholder has to resources (e.g., how frequently they interact directly with pigs), the level of importance of the resource to stakeholders and the knowledge systems used to make decisions. Abbreviations are as follows: Agriculture- agricultural managers, Government- government managers, Environment-environmental managers, Traditional Owners- traditional land owners.

Authority /Potential Power	Stakeholder	High Stake/ Importance	Low Stake/ Importance	Connection To The Resource	Knowledge Systems
High Influence /Power	Agriculture	0	3	2 Low 1 Intermediate	**Science Based**
	Government	2	1	3 Low	
	Environment	2	9	6 Low 4 Intermediate 1 High	
Low Influence /Power	Grower	15	0	High	**Experience, Culture/ Historical, Science**
	Traditional Owner	4	1	Intermediate	
	Hunter	15	0	High	

Importance Of Resource To Stakeholders

The feral pig resource is important to the hunters and farmers that participated in the study (Table 3). One hunter described the importance of pigs and being a good hunter this way: "anyone that's got the love and the passion [for hunting] and the respect; the respect of the animal as well as the environment, and the properties, and the knowledge you're given and shared along…Like I say, I believe I'm helping the Australian bush for every one [pig] I can remove….I wouldn't say I'd wipe them out, because that would take away some of my enjoyment and what I'm so passionate about, but I'd definitely try and reduce their breeding potential."

TO relationships to the resource are noted as high and low, because there was not full accord from the five participants. Four of the TOs interviewed expressed that pig management,

in the form of pig control, was important to them. Pigs "are a very dangerous health threat to the country" according to one of the TOs; another felt that "everything's interconnected, you touch one, you touch everyone. At the moment only white fellas are touching them, the pig touches everybody, even everyone else in the environment here." A fourth TO described pigs as a management concern, saying that "up until coming to work here I thought they were just food, but … I see the amount of devastation that they actually do do. They're just taking food that native animals are looking for as well, so you know they're no good on the environment." The final TO appeared to be ambivalent about the relevance of pigs. He did not consider the presence of pigs to be a problem and he did not want to see pigs eliminated, but he didn't mind a bit of pig control. He said, "I'd rather keep them [pigs] around a bit for you know, so we can get extra food. Free meat maybe. ….We manage pigs you know; try not overbreed I suppose. Otherwise, you go to the river and there are too many pigs there….[but] it's only the farmer that's having the problem not us."

Managers had mixed responses to pigs. For most of the managers (13), pig management was of low importance in comparison to other management concerns. For example, one manager said, "I guess, even on our - to a certain extent, to at least some people anyway, on my board are of the opinion and I'm probably of a similar opinion, that compared to some of the other diseases facing the sugar industry…. pigs don't really, economically, aren't anywhere near as big a problem as those aforementioned diseases. So we don't really put a big priority into it." Other managers (4) considered pig management to be of high importance. For example, one government representative said that feral pig management is "an important issue. The reason why, is that the number of feral pigs have increased significantly in recent years because they're not controlled properly. My view is that, notwithstanding the efforts of private land owners, …

feral pigs have safe havens in state controlled land estates. …It's a significant estate for feral animals to hide in and flourish in if it's not controlled properly. My view is that not enough resources are put into the management of our current national park estate and state controlled land generally."

Knowledge Systems

Local knowledge is held by farmers, hunters, and TOs (Table 3). Although there are differences in the knowledge held by stakeholders in this group, they generally share a similar knowledge system based primarily on personal experience and cultural/historical interactions. One example of this kind of knowledge can be seen in trap design. Both hunters and farmers design traps, which they modify and perfect through use, their daily experiences, and knowledge of pigs. In this case, a local bow hunter who is also a farmer created an innovative trap design, which is described here by his friend, a farmer, "it's a trailer trap which [he] did design, and the bow hunters, and [some farmers] in here made the first ones up. It's got a bit of history about it. Great idea. You could tow it and lift it up, tip it over, upside down and you've got a pig trap. Great….they're a great idea. They're magic. Then we had to change the door mechanism, because somebody thought if a kid went in there he could get squashed because the door used to come down this way." This trap, while initially designed by one individual, was modified based on the experience of a group of hunters and farmers. Science also has a role, but one less significant than the other two sources of knowledge. One banana hunter, when discussing pig control acknowledged, "Yes, I don't know whether baiting or a type of chemical, you know, biological control as well. I don't know how effective that is, because science is the only one that knows what's best for that."

Managers, on the other hand, strongly value scientific knowledge (Table 3) produced through experimentation using formal research methods and disseminated through scientific literature. Managers also highly value the expert opinion of professionals trained and experienced in this field. This knowledge infuses every aspect of pig management, from manager training ("I was trained as a forester so I have a Bachelor's of Science degree with a major in forestry and I suppose that [I've] principally been utilizing that for land management purposes"), to daily on-ground activities ("I'm very hands on orientated, but with a scientific slant, if you understand what I mean. So the projects are still run by scientists at various levels...supported by technicians or experimentalists"), and to the facts employed in management planning ("all the research says that you need to knock out something like 70 to 90% of the population to make a long-term difference… [and] the research shows that the carrying capacity of national parks is very low"). Scientific knowledge is also used to assist local community members ("we can help you do this, we can give you a pest fact sheet").

Communication And Relationship Charge

The kind of communication that exists between pig management stakeholders provides context for understanding the social environment in which characterization frames are created. I found a spectrum to the degree and type of communication exchanged between feral pig management stakeholder groups. The strongest relationships were the most positive and the weakest ties tended to be the most negative. The link between weak ties and negative communication appeared to be the result of: 1) a lack of desire to connect with a group in which existing negative perceptions were already formed, or 2) the sense that there is no communicative interaction where there should be such an interaction. Farmers hold the strongest and most positive communication with other farmers, family, hunters, and neighbors. Farmers

have intermediate communication with the cane industry, Boar Busters, and Terrain within the Manager group of stakeholders. They have the weakest ties or no ties to environmental managers and government agencies. These ties are also the most negative. Farmers generally do not mention TOs. Farmers have no ties to TOs with regards to pig management, but this is usually considered neutral rather than negative.

Hunters share the strongest and most positive ties with other hunters, friends, family, farmers, and hunting organizations. Hunters have intermediate connections with equipment providers and 'reckless' hunters and weak and the most negative connection to managers. TOs are generally not mentioned, but if mentioned ties are weak and neutral; hunters sometimes provide meat to TOs.

Managers describe having the strongest and most positive connection to other managers, an intermediate connection to farmers, neighbors in general, the community, and the federal government. Managers have little or no communicative ties to TOs and hunters. Ties to hunters are, overall, negative. Where ties exist to TOs, unlike with other weak ties, these tend to have a neutral charge.

Since the TO group represents only five participants, I cannot provide an accurate spectrum of communication for this group. There was variation in the nature of the relationships of these stakeholders. All the TOs described strong ties with friends and TOs who were hunters. Three of the five TOs described weak or no ties to recreational hunters. The other two described strong relationships with hunters who are also friends of these TOs. Relationships with farmers and managers were mixed and there was no clear overall prevalence of strength or weakness of relationships with these groups.

There were also some differences in the ways in which information was transmitted between groups. The mode of communication and the ways in which these forms of communication were employed varied. Farmers, hunters, and TOs described mainly the use of face-to-face conversations, phone calls, social gatherings, the Internet, letters, newsletters, newspapers, clubs, entertainment, and gossip. Managers referred most to e-mail, the Internet, telephone, face-to-face communication, conferences, journal articles, internal memos, and news articles as communicative modes of transmission.

Characterization Frame

Negative stereotypes tend to occur between the stakeholder groups that do not work closely together. For example, farmers and hunters live and work closely together, and the various managers work closely together. The government representatives have ties to both groups, and TOs have claimed some ties to both groups. The stereotypes used by stakeholders in this study contribute to the justification for the inclusion or exclusion of particular groups in the management arena and the use of particular management regulations.

The prevailing stereotype of farmers comes from managers. The stereotype describes farmers as smart and hardworking, but exaggerating the importance of pig damage. They are frequently described as emotional and regularly complaining about pigs. Farmers want the onus of pig control to be carried by managers, with less input from farmers themselves. Environmental managers in particular believe that many farmers harbor negative perceptions of these managers, including the belief that managers are responsible for high pig populations, because they are harbored in national parks. These managers feel farmers need to take greater ownership of the pig problem. As one manager stated, “at the moment, [for farmers,] the easiest thing to do about

pigs is to sit around whinge about them and say that the government and others aren't doing anything, or don't know what they're doing."

The stereotype of hunters has its foundations in national stereotypes of hunters as irresponsible and destructive (Bauer and Giles 2002; Sharp and Wollscheid 2009; Tisdell 1982). In the CCRC, these perceptions are held widely by managers, some TO participants, and one CCRC representative. At best, these stakeholders view hunter activities as interfering with research and pig control methods, or hunters may not be considered relevant, because they are not permitted in the national parks where some of the managers work. Most of these managers and TOs view recreational pig hunting as an ineffective management method. At worst, hunters are perceived as conducting illegal activities, causing damage and destruction to property, stealing gas and equipment, and trespassing. TOs and managers generally believe that hunters keep vicious dogs that attack people, wildlife, and each other. The hunters, it is said, do not have any regard for the care of these dogs and treat them inhumanely. Managers and TOs often feel that hunting practices are generally inhumane and that hunters kill native wildlife. They suggest that hunters also vandalize pig control and wildlife protection efforts; hunters damage and steal pig traps, release new pigs onto properties, and damage national park property. Hunters are described as being anti-pig control. One TO had this to say about dog hunters in particular, "pig dogs are definitely not the way to go because they frighten - they do more harm than good and the people that get out there, they're callous. They like to see the animals squealing. I often wonder they can't go murdering other human beings so they take it out on the pig. I've seen very cruel people. People who do that kind of thing have always got a very bad attitude socially."

Most managers feel hunters should play no role in management. One exception was one environmental manager, who felt that recreational hunters could be a useful resource for

management in conjunction with other management strategies, but liability issues, and timing issues have prevented his use of hunters to assist in management projects. He felt that when "we want to clean up 1 or 2 or 3 pigs that have demonstrated they're trap shy or whatever um that, that dogs could, and I'm sure, have been, trained to be specific enough if you get the right dogs and the right people to, to seek and bale up pigs so that you can deal with them. … I'm sure as a baling dog, there are people around with them and the people who I have talked to have great success in their cane paddocks and around the cane paddocks...it would be someone…[I] would target locally or, or I would get a dog and train it myself so depending on, depending on who I could find, but there are 2 people I know that use bailing dogs… they've already got dogs so that would be my first choice to use them."

Hunters are well aware of this stereotype. One hunter described "dealing with the general public and people who have no idea about pig hunting is a hard one. I try and change people's perceptions on that because a lot of people think you're a blood thirsty maniac, because you enjoy going out and catching a feral pig. Which isn't right." Many hunters tend to be very private for this reason. One farmer told me about two valued and trusted hunters who worked on his property. The farmer explained, "I've got a photo of them (laughs) and they've got their back turned to me, telling me to bugger off, very shy, yeah." These hunters refused to have photos taken by the farmer while conducting hunting activities. One of these hunters described his experience as a result of this kind of stereotype, "it is hard to get the trust of farmers these days, so there is a lot of land, private land, that is not hunted and that make it a perfect place for pigs to hide. When I asked a farmer if I could hunt his place for pigs [and he had a lot on there] he said no and said to me that pig hunters cause more trouble than the pigs." Another hunter, who is a professional environmental manager, discussed the stereotype of hunters, "there's the rogue

elements that don't appreciate private property or park boundaries and that's a concern, because it sets a bad image and it's a problem.....Those rogue elements, it's detrimental, because when you talk within park fraternity - for instance, about pig hunters - well, that's what they've got in their head; that rogue element that's, oh yeah, we don't want them involved, whereas that represents a portion of what can be sometimes a very, very, very sound practice to move or eradicate pigs."

Stereotypes of managers particularly focus on environmental and government managers. These beliefs are held by hunters, growers, local council representatives, and some TOs. The descriptions provided depict managers as elitists who do not value the opinions of anyone who is not a manager. Stakeholders believe managers do not listen and that their knowledge comes from research that does not reflect real life. The stereotype suggests that managers are disconnected from the pig control problem. They don't care about pigs and do nothing about pig management. The stereotype also affirms that manager activities lack transparency. They occasionally throw money at pig control with political motives- to make it look like they are responding to farmer concerns. After this show, the funding stops. Managers are also depicted as unreliable. "They tell us what to do, but harbor pigs on their land," said one grower of managers.

These stakeholders felt that managers do not claim ownership over pig control. One hunter had this to say: "legislation... it basically leaves the ownership of the issue in the landholder's hands and the government takes no ownership of the issue basically is what it boils down to." One grower said, "They [managers] say they do this and they give this and that, but it's - the facts speak for themselves, they don't control no pigs. They might control an odd one now and then." Stakeholders comment that "if you had an honest appraisal and look at what's happening in our little world with World Heritage here, you'd be pretty disillusioned that

government can lock it up ....and to not take any management of it is yes, is not the right attitude to have."

TOs have significant roles in the management of some environmental concerns in the CCRC, particularly in the management of the Great Barrier Reef. QPWS has several indigenous staff in the region and Girringun also now has its own TO rangers to assist in the management of TO lands. There is, however, very little mention of TOs by any stakeholder group when discussing feral pig management. Managers sometimes describe the main interests of TOs in regards to pig management as having an interest and enjoyment in eating pig meat. Manager, farmer, and hunter groups generally felt that TOs were either not interested in pig control, or not interested in participating in pig management actions. One environmental manager said, "traditional owners have concerns about pigs and the damage they're doing on the estate and on other lands..., but I haven't seen where it's actually, they've taken an active role in it." One of the few exceptions was an environmental manager who said that he thought "they [TOs] express their concerns for pigs and they express desires to get involved in land management activities...[,but] the mechanisms to get traditional owners involved in feral animal control are virtually non-existent under current relationships." This environmental manager said he would like to see more inclusion of TOs in committees for management planning. He felt that if TOs were interested they should be allowed involvement. TOs did not discuss how they felt they were perceived by other stakeholders. They did discuss how they saw their relationships with managers, "No we've got no contact with the National Park and we just - well I do anyway- I just mind my own business. I don't care what the National Parks do. [After all] I wanted [to work with them], but I don't care what they do now they can help themselves." Another TO said, "we can talk 'til we're blue in the face and nothing will happen. But if we put it down and you've got

it down there, use it. At some stage it's going to come back at them and they're going to say, well look, why haven't we involved these fellows with Landcare? Why haven't we involved these fellows with streamline rehabilitation? Why haven't we involved land owners and national parks? Because they're there, the traditional owner is there, who can actually be part of it." Most feedback about TO roles was only provided after prompting by interview questions. Stakeholders that described having some kind of relationship with TOs said they had good relationships with them. Sometimes these relationships were in the realm of environmental management, but generally not in regard to pig management. Other stakeholders had TO staff on their properties and described only that they had mixed relationships with them.

At this stage, I will introduce an additional group of 'stakeholders'. They are a stereotype of a subgroup of hunters. This stereotype is held by people who work with hunters or are themselves hunters. This description is derived from farmers, hunters, and other stakeholders who interact regularly with hunters. It is the stereotype of the 'reckless hunter', referred to by some as 'poachers'. I will refer to this category as 'reckless' hunters, because not all those who describe this stereotype refer to this group as poachers. The word 'poacher' has a strong, distinctly negative, connotation to which not all the stakeholders defining this category ascribe. This is not to be confused with the hunter stereotype held by managers and TOs. Farmer, hunters, and other stakeholders believe that there are many excellent, reliable, helpful hunters, but feel that there is a fraction of the hunting population that is 'reckless'.

It is important to first comment that for hunters, there is a certain etiquette or informal normative guide to hunting activities. It is beyond the scope of this paper to describe it in detail here. The most relevant point for understanding this stereotype, however, is that there is a behavioral spectrum in regards to hunting etiquette. There are hunters who describe crossing

certain etiquette guidelines, but consider these minor breeches. For example, a minimal breech of etiquette might be crossing over the edge of a property boundary where the hunter is permitted to retrieve a dog or pig on a neighboring property. An extreme breech would be theft or property damage.

The cost of disregarding normative guidelines is that hunters lose social capital. Social capital is the currency for gaining legitimate property access. The loss of capital can thus lead to the loss, or difficulty in, gaining access to hunting properties. These reckless hunters can lose the association of other hunters and they can lose their membership to any hunting organization of which they may be a part. These organizations usually provide the benefit of hunting insurance, so the loss of membership means the loss of this insurance cover. In extreme cases, hunters can suffer financial or physical damage by farmers if caught trespassing or else these hunters might be punished by the formal normative structure. This can result in outcomes such as the loss of weapons, gun licenses, driver's licenses, and the receipt of fines.

Reckless hunters are said to include a segment of the following: 1) young hunters who are ignorant, bored, or rebellious; 2) strangers from other regions who have no sense of attachment to the local area and feel etiquette breeches will not impact their social capital because they are just passing through; and 3) 'criminal elements' -people who in their daily lives, not just when hunting, are generally 'criminals'. Several of the hunters I interviewed feel that the young reckless hunters can be taken in hand successfully and taught the importance of following etiquette guidelines, and those hunters who were interviewed feel that this is often done successfully. One hunter said, "a lot of the times there was a lot of young fellas and [you] just say to them basically, you tell 'em come on fellows, you know you're not supposed to be here.

Just, if you want permission, go and ask the farmer now, you know what I mean, just go and ask. Just ask them, if they say no the first time, come back a month later and see them again."

Not all strangers are reckless hunters. The traveling hunters I interviewed had the sense that social capital is not just banked in your local community. There are prime areas in QLD for hunting and if you want to have the opportunity to return to these sites, you have to maintain this capital when you travel, you need, in fact, to be even more careful to follow etiquette, because people are more suspicious of you as a stranger. Then there is the 'criminal element' that deliberately causes harm because that is what criminals do.

Some farmers consider all 'reckless hunters' to be 'criminal elements'. Others share a sense of 'reckless hunters' that include the 'young hunters', 'criminal hunters', and may or may not include 'stranger hunters'. One grower explained, "the problem that we have had is some hunters, you get guys coming up from Mackay, Tully, areas that aren't from around here, and they start stealing fuel and tools and damaging things and stuff like that so they give, they, quite often, they give the local hunters a bad name because of what they're doing so poaching is, poaching is a big issue, where they're stealing stuff." The interactions between farmers, hunters, and reckless hunters vary, "there was good experiences and then there was bad ones. Yeah, sometimes they [a run-in with a poacher] can be, sometimes they can sort it out peacefully which, you try and do now. [When finding a poacher] sometimes things got a bit heated, um I even had one farmer tell me one day, I don't care what you do, he said, I'll pay all court costs and ahhh, just you know what I mean it's just, there are diplomatic ways to get around things. "

Identity Threats, Power, And Social Control Frames

The clearest way to understand identity threats, power, and social control frames within the feral pig system is to examine these attributes within the arena of the pig management social

structure. There are two principle social structures that interact at the nexus of feral pig management. The first consists of TOs, farmers, and hunters while the second consists of managers. These structures adhere to different norms and knowledge systems.

Farmer/Hunters/TO Social Structure

This social structure, which encompasses farmers, hunters, and TOs, which I refer to as FHT, revolves primarily around informal norms. In this arena, knowledge systems about pigs are based on personal experience, and cultural/historical interactions; science also has a role, but is not considered as significant as the other two sources of knowledge. In this realm of feral pig management, power is derived primarily from either resources or personal power (Lewicki et al. 2003). Farmers, for example, have resources available that they can apply to pig control actions. These come in the form of time, tools such as pig traps, helicopters, guns, and funds to, for example, employ people to control pigs on farm properties. Personal power is based on social capital. Social capital provides validity to pig management beliefs and values. Social capital contributes believability to the 'truths' they present about pig damage and pig management. While expertise power is also important, it is not really an independent entity; it is not recognized unless it is coupled with personal power.

Sense of place is important to the social structure of these stakeholders, because it is an element that holds the stakeholders together. While each stakeholder group has its own, somewhat different, sense of place, and even though not all these stakeholders are considered 'local' there is still a sense within the social structure that these group members are generally 'locals'. They belong to this place, they are mostly long-term residents of the CCRC, and the individuals are known to each other. They are all part of the local communication system. Their activities are known to each other and reasonably transparent.

Manager Social Structure

The institutions of the manager social structure are primarily focused on formal norms. Manager knowledge systems are based on scientific knowledge and experience. Power is associated with available resources, and also authoritative and expertise power (Gray 2003; Lewicki et al. 2003). Every manager role provides some degree of authoritative power that is backed by the formal normative structures of the government and legislation. Managers are thus imbued with the power to make and enact management decisions. Expertise power is also important. The foundation of knowledge in this group is scientific evidence. Information derived from this kind of knowledge is valued, so results from experimentation and professional experience are also valued. These groups also tend to have a shared communication system that differs somewhat to the one employed by the FHT structure. Outside of a sense of responsibility to the particular area where they work, and for most a general sense of being separate from the local community, no shared sense of place exists amongst managers. The reason for the lack of uniformity in sense of place is because the employment of managers is based on skill, therefore, they can be hired from any part of the world. Some managers from distant locations consider the area home, but not others. Local residents often have a local sense of place, though not always, and within the bounds of their roles, these managers often still consider themselves separate from the community. Even the sense of place about the area where they work can vary; this may be the particular piece of public land on which they work, or for a few, it may be more encompassing of the region as a whole.

Identity Threats

Identity threats are described by stakeholders as not just a lack of recognition of core values, but also an attack on knowledge systems. One farmer said, “We’re used to being told

what we have to do, not asked, and often by people who are not that knowledgeable. A lot of growers have had a lot of experience with it and maybe thought about it." Another farmer and sometime hunter said, "We were wanting to try a trip mechanism ... so we wouldn't catch wallabies or cassowaries. His mechanism, all it used to do was catch cassowaries and wallabies and very few pigs. We said it's wrong. [The manager replied] no, no, that's staying like that. I was going to eat him and [another farmer, my friend] said no, no,...no, another day, we'll both eat him. So since that time, yeah, and [he was] always bad mouthing that the farmers knew nothing." Members of this informal structure feel ignored and undervalued by these managers and feel that managers make little effort to appreciate FHT member interests. This social structure also believes that the managers show no interest in genuinely increasing their social capital, which shows disrespect for a core value of this informal social structure. FHT members also feel that managers intentionally try to deceive them. When managers occasionally throw token amounts of money to control pigs, FHT members recognize this as a false and strategic move to pretend some interest in pig management. These sentiments only serve to further devaluate the opinion of managers and their actions in the eyes of the FHT structure.

Stakeholders also attack manager identity. Not all managers are aware of these sentiments, but those who are, have familiarity with the content of these attacks. One manager said, "we predominately feed information to [the community] and they feed back their displeasure about non-activity, or perceptions." Another manager said "you can't not have pigs on your radar…because if you don't have them on your radar, the neighbors are soon off side with you and making noises; that changes the way you think about pigs". A third manager said "there's a perception from farmers and the community that they breed up in our country and these hordes of pigs coming running out." However, because these charges are made by

stakeholders with less authoritative power than managers, they may not have as powerful an impact as they do on those with less authoritative power.

Power Frames

The feral pig management socio-ecological system draws on six of the nine power frames described by Gray (2003). The types of power described by these frames are: authority, resource, expertise, personal, coalitional, and voice. Both the FHT and Manager groups are in accord that the authoritative power to make formal decisions and changes to pig management are in the hands of the managers. I found a generally inverse relationship between authoritative power and the relationship to the resource (Table 3). Those with the most authoritative power tended to have the weakest relationship to the resource. One farmer said, "none of these fellows have ever seen a pig in the wild. They've probably never seen a pig, some of these government people, so to see them, how savage they are in a trap and everything, gives them a good idea that we have a problem." Those with high authoritative power all fall into the Manager group and those with little authoritative power and strong connections to the feral pig resource are part of the FHT social structure.

Voice power is also recognized by both groups. Farmers are widely able to make their concerns about pig management heard within the general community. This is part of what has led to managers providing some response to their concerns. Meanwhile, hunters have little voice about pig management in the community. Their views are usually not acknowledged within the general community. TOs have practically no voice in regards to pig management. The extent of this lack of voice is such that most stakeholders do not associate them with pig management. Managers have significant voice power in the community, in part, due to their roles in formal institutions and their abilities to take advantage of media resources.

There are other important types of power that function in the pig management arena. They are resource, personal, coalitional, and expertise power. There is some dissonance in the use of these forms of power in the two social structures. These sources of power are not uniformly used in both structures; they are evaluated differently or are not generally considered relevant in one or the other structure. It is this disagreement that provides for another source of conflict between the social structures. There are members of each social structure that hold resource power. These resources include monetary funds, pig management tools (e.g. vehicles, guns, traps and dogs), time to enact management, and assistants to carry out management. The FHT society holds that managers have the most resource power. Farmers and hunters also hold some resource power, but to a lesser degree. The Manager group acknowledges that it has resource power, but believes that farmers also hold sufficient resource power to manage pigs. The managers feel that farmers apply only a very limited amount of their resources to pig control and that they are too dependent on outside assistance from managers.

As previously described, personal and resource power are the most important sources of power in the FHT society. Most members of the manager society either are unaware of, or do not acknowledge, the importance of personal power to the FHT social structure. This is a key distinction, because in the eyes of the FHT structure, managers hold little or no personal power. Personal power has far less significance to manager society. Expertise power- in this case power associated with academic/scientific knowledge- is far more important to planning, regulating, and enacting pig management decisions (Lewicki et al. 2003). Coalitional power is the power associated with group membership (Gray 2003). This kind of power is important to FHT members, but is not as important to managers. Despite some discord between the stakeholders of its membership, FHT society is unified by its shared norms, knowledge systems, some

communication networks, and, to some extent, sense of place. These dimensions provide unity within the group, which provides the power for its informal pig management structures to function, but also gives them some power in association with the managers. The occasional funds infused specifically into pig management by the federal, state, and local government arrive partly in response to the need expressed by the FHT society, particularly by farmers. Managers do acknowledge the presence of this kind of power in the community and occasionally provide funds and resources in response to FHT member desires.

Social Control Frames

One of the ultimate struggles amongst stakeholders is the question of the decision-making process in management. The two aspects of social control frames examined here are: 1) how dependent stakeholders should be on each other in order to make management decisions, and 2) who should have ownership over the management process (Gray 2003).

Power relationships affect a stakeholder's sense of interdependence. In the pig management arena, there are two sets of power systems functioning in tandem: informal in the FHT social structure and formal in the manager structure. FHT members consider themselves to be highly dependent on the manager structure. While there are management actions they can perform within the power system of the FHT structure, ultimately they are dependent on the manager structure for larger legislative changes and the infusion of resources. The managers meanwhile describe themselves as having low dependence on the FHT structure, because managers hold the authoritative power to enact significant management change.

A sense of ownership over management processes is the other important consideration of social controls. Those in the FHT structure generally feel a strong sense of ownership for feral pig management (Table 3). FHT members feel that while their sense of ownership of pig

management is important, all farmers, including those that do not have pigs on their properties, and managers should take greater ownership of the pig problem. The importance of TO ownership was only discussed by TOs. Farmers and hunters did not think ownership by TOs was particularly required in pig control. Farmers also did not consider hunter ownership as a prerequisite for successful pig control. Managers tended to show a low sense of ownership over the resource. They generally managed pigs because it was a requirement by law, but it was not a management priority. Managers generally felt that farmers should take greater ownership over pigs, but ownership by hunters was either described as undesirable or else not required and ownership by TOs was not something described as a requirement by managers.

Discussion

Dueling Societies: The Social Context Of Pig Management

When the Farmer/Hunter/TO (FHT) and the Manager social structures interact with regard to pig control, they clash. Conflict is not necessarily a bad thing. It helps to highlight features of management systems that may need to be altered or that do not fit with current stakeholder needs. It is only necessary to have the opportunity to make these changes (Alston et al. 2005; Buckles and Rusnak 1999; Habermas 1984). The concept behind the two structures described in this study is particularly important to understanding why conflict occurs between stakeholder groups. One of the most fundamental strategies for both avoiding conflict and alleviating it is for managers to perform a deliberate evaluation of stakeholder social structures in their community. This would provide managers with a better perspective on how to engage stakeholders in management. It is important for managers to understand not only the role of relevant local stakeholders, but also to consider their own positions and values in the community

and how these impact management. Thus the evaluation of social structures should include contemplation of the role of one's own social structure within the context of the society of which it is a part. When examining social structures managers should consider: 1) normative values used to determine the rules of resource use, 2) knowledge systems, 3) valuation of power, and 4) sense of place. An understanding of social structures also provides insight into the communication systems between stakeholders as well as the illusory barriers that result from misunderstandings between stakeholders in the two structures. This section examines the impact of the four features of social structures on management practice.

Knowledge and Power

FHT and Manager members use two different knowledge systems. For FHT members, knowledge definitions are based on a mix of experience, culture/historical evidence and some traditional science. Most of the members of this group feel a strong connection to feral pigs regardless of whether they feel a positive or negative connection to the resource. They have daily or weekly direct contact with pigs and regularly practice pig management methods. One of the directives for knowledge in this group is to collect and learn information that can be useful for catching pigs in greater numbers and more efficiently. This is a common function of local knowledge and there has been a substantial collection of literature examining this kind of knowledge (Johannes 1981, 1989; Johannes et al. 2000; Russell and Harshbarger 2003). Felt (2005), for example, in a study of knowledge practices among fishers in the Smith Sound in northeast Newfoundland, found that fishers have an extensive knowledge not just of the fish species they collect, but also of the local ecosystem itself. Fisher knowledge for managing fish stock is tested and adjusted daily through trial and error, and information that fails to provide the desired results is rejected.

The manager knowledge system is primarily science based. This knowledge is collected through rigorous and regulated testing using the scientific method in the laboratory and field, as well as from professionals trained in this field and using these methods. This method has a long history of association with natural resource management (Adams and McShane 1992). Some managers have strong connections to feral pigs, dealing with them on a daily basis, but most have intermediate or little contact with pigs.

Foucault (1980) described knowledge and power as being intimately connected. There are many different kinds of power and depending on the social structure, and the situation, the dominant power can promote a preferred kind of knowledge system (Blaikie et al. 1997; Foucault 1972, 1980; Habermas 1975; Kellert et al. 2000). For members of the FHT structure, social capital is a core principle in determining the validity of management decisions. Social capital refers to capital built on reputation and social status and determined through interpersonal relationships (MacGaffey and Bazenguissa-Ganga 2000). Social capital serves as a tool for forming and measuring relationships. Those individuals who have high social capital may be considered socially more powerful, authoritative, or more reliable and trustworthy than others. These individuals are more likely to attain loans from friends, family or trade partners and are highly sought after for social or economic interactions (Russell and Harshbarger 2003).

Despite the fact that the FHT group can appreciate value in some scientific knowledge, they appear to have very little respect for the particular knowledge promoted by most managers. This is, in part, because some managers lack the social capital needed to support the value of this scientific knowledge. Managers lack legitimacy in the eyes of hunters, farmers, and TOs; these stakeholders do not trust managers and by extension have little faith in their type of knowledge and actions. Managers are considered to lack the on-ground experience necessary to understand

the pig problem. For many FHT members, managers also generally lack a strong sense of place, that is, a strong sense of attachment and commitment to the region.

Managers, meanwhile, consider the FHT group to lack legitimacy. FHT knowledge is the wrong kind of knowledge. In the eyes of Managers, knowledge is derived through the use of scientific methods. The knowledge of the FHT structure lacks the rigid testing required by the scientific method. The beliefs, therefore, are not 'facts' and are not reliable sources for creating management decisions. Managers function within their social structure and make decisions based on their own *umwelts* - what seems reasonable within their own life worlds or frames - with little reference to outside stakeholders (Habermas 1984, 1987).

The result of these perceptions is that the resources and knowledge that each social structure might share with the other is ignored. In a realm of conflict in which solutions are desired for natural resource management issues, ignoring available knowledge can have significant consequences. In the field of natural resource management, value in scientific knowledge has long been accepted. Scientific knowledge is important and provides great insight and understanding of small scale ecological systems (Gadgil et al. 1993). The value of local knowledge to natural resources management however, has begun to be appreciated in the last 20 years (Berkes et al. 2000; Johannes et al. 2000; Kellert et al. 2000; Robertson and McGee 2003). Local knowledge can also provide valuable insight for management. In Newfoundland, prior to the collapse of the North Atlantic cod fishery, inshore fishers warned biologists that spawning stocks in their fishing areas were dangerously low. Resource managers, who were focusing on offshore fish stocks, ignored these and other warnings and the ultimate result was the demise of these fish populations (Finlayson and McCay 1998). Another example is the restoration of beaver population in James Bay, Canada (Berkes 1999). The Cree Indians were disenfranchised

in 1920s and so their land management practices, which were based on local knowledge, ceased. In the 1950s, when the land was returned to the Cree, beaver populations were restored when local management strategies were reinstated.

Knowledge is also important in ways not directly related to the value of the knowledge itself. Pig management legislation and actions are formally developed and approved within the Manager social structure. This structure holds authority power over pig management in the CCRC. The manager structure has access to resources and sanctions that are not available to the FHT structure. The approved form of knowledge used to develop and maintain pig management policy in the manager structure is scientific knowledge. This is understood by the FHT structure and its members resent the fact that managers ignore the value of local knowledge. This leads to one of the points of conflict between the two management groups. In response, the FHT structure, which has its own power structure system, continues to apply local knowledge into their everyday management activities in ways that are not always in accord with formal management policy.

Communication Failure

Poor communication between the two social structures is another source of conflict. Stakeholders generally had stronger and more positive communicative ties with members of their own social structure and weaker ties and communication with members of the other social structure. These groups are thus, communicatively, somewhat isolated from each other. The social structures have essentially formed their own cliques. Lewicki et al. (2003) describe party or group affiliations as one contributor to conflict escalation. The formation of affiliations can serve the beneficial function of protecting group interests and assisting management within these groups, but affiliations can also increase dissention between groups. It is not necessarily the

bonds that form between the individuals within a group that lead to discord, rather, the exclusion or stereotyping of other groups or individuals that is most contentious. These kinds of groups, or cliques, can lead to the deterioration of the solidarity of the overall social system that includes all feral pig stakeholders (Katz et al. 2004; Markovsky and Lawler 1994; McCarty et al. 2007).

The poor communication may in part be the result of lack of understanding. The two pig management social structures communicate with each other using their own speech acts, and due to the nature of the differences between these structures, the meaning of the speech is lost. The speech acts that occur between each group are often misunderstood, as if each group speaks an almost entirely different language, like a Spanish speaker talking to a Brazilian Portuguese speaker, where the gist of meaning can be understood, but much can be lost in translation. Poor understanding of the context of speech means that there is no shared arena of interaction in which stakeholders can negotiate in a clear and transparent manner. Scheff (2005) describes 'mutual awareness' as a key element for successful discourse and, in this case, successful management. Mutual awareness is about "not only understanding the other, but also understanding that one is understood, and vice versa" (Scheff 2005). Both managers and FHT members are failing to understand each other's social structure and thus the value system of the other group, and also not realizing that they themselves are misunderstood by the other group. Differences in modes of communication between the two groups can also lead to poor communication. Modes most commonly used in one structure may not be used at all in the other. Additionally, shared communication methods may be applied differently between the two groups.

Illusory Management Barriers

Habermas (1984, 1987) wrote that in order for formal institutions to be successful, they must be reflexive. A reflexive system mimics the regular evolutions of everyday life. It assists in the development of a system that is adaptable and changes with changing environmental and stakeholder needs and conditions. A reflexive system is cooperative; stakeholders are able to work together and use a shared value system (Habermas 1984, 1987; Helmke and Levitsky 2004; Scheff 2007). In contrast, due to lack of flexibility in the management process and lack of, or misunderstanding of, shared values, there is a failure in the reflexive process of the feral pig management system. For FHT members, the lack of flexibility is reflected in the sense that the manager social structure was unable or unwilling to assist them with their management concerns.

One of the results of the lack of flexibility is that FHT members have their own set of norms (informal rules) for managing pigs and these rules are not always in accord with the formal norms (regulations/legislation/laws) determined by managers. FHT members have conducted management activities as it could under the auspices of the informal normative structure. This informal structure, however, cannot successfully function independently of the resource power and authoritative power present in the managerial structure. The informal normative structure alternatively acts as a substitutive or competing institution with the formal social structure (Helmke and Levitsky 2004; Lauth 2000). The informal FHT social structure attempts to compensate for what is considered "ineffective formal institutions" (Helmke and Levitsky 2004). It does this by complementing existing manager management strategies (e.g., using electric fences or trapping pigs on farms). The FHT structure acts in a substitutive manner - acting where managers do not - when it operates outside the bounds of the formal or legal rules,

for example, by pig dog hunting in national parks. This disparity can lead to failure in the formal management plans created by managers.

There is a lack of solidarity among stakeholders in the system. A symptom of this lack is the blame ascribed by participants to each other. This is sometimes referred to as 'fundamental attribution error'; no one takes responsibility for their own errors and blames it all on someone else (Satir 1972; Wondolleck et al. 2003). Scheff (2007) describes this kind of scapegoating as a symptom of groups working in isolation rather than in solidarity. The structures become isolated from each other. This isolation encourages the perpetuation of identity threats and negative stereotyping.

The negative stereotypes and identity threats facilitate miscommunication and an arena where the already contentious issue of pig management is further aggravated by the creation of illusory barriers between the stakeholders. The results of this kind of interaction can be poor management decision-making and increased volatility in conflict between groups (Buckles 1999; Lewicki et al. 2003). The values and characteristics ascribed by stereotypes can differ significantly from the reality. These then, represent illusory barriers - barriers to pig management that are presumed, but do not actually occur.

The description of CCRC stakeholder pig management beliefs and values detailed in Chapter 2, demonstrate the origins of some illusory variables. It also presents the genuine values as described by the stakeholders themselves and when compared to the stereotypes presented in the current study, serves to support the vast difference between stakeholder truths and those expressed by the stereotypes. For example, while consensus exists among all stakeholders - hunters, farmers, TOs, and managers - that pigs cannot be eradicated, many managers think farmers expect complete eradication of pigs.

Other illusory barriers can be seen in the stereotype characteristics described in this study. It is valuable to review the results regarding stereotypes in order to demonstrate points at which illusory barriers have developed. For example, the managers' stereotype of hunters presents them as irresponsible, destructive, and against the management of pigs. Hunters say that they do not feel they are the irreverent actors they are portrayed to be and that like any group of individuals, theirs includes many intelligent and responsible constituents. In addition, they are happy to see pig management occur, because hunters just as all other stakeholders feel pigs cannot be eradicated. The hunters' actual perspective differs from the stereotype and provides more flexibility for collaboration in pig management. The consequence is not only a lack of understanding, but the distancing between the two groups and results in a lack of clarity about the roles and actions of other stakeholders in pig management. There is also the general sense of dissatisfaction as a result of the feeling that the values and opinions of the other group is not appreciated or respected. This is in accord with studies of personal identity and stereotypes that suggest that negative stereotypes can cause avoidance, exclusion, fear, and aggressive behaviors between parties (Brynn 2007; Chugh 2004; Crookes and Thomas 1998; Goffman 1959; Helm 2007; Iavicoli et al. ; Jiang et al. 2009; Ko et al. 2008; Lippman 1921; McGregor 2000; Medin et al. 2007; Pandey and Welch 2005; Schaller and Conway 1999; Willis and DeKay 2007). These kinds of discriminative behaviors can also lead to "counter discriminative" responses, thus perpetuating conflict between parties (Abreu 2001; Bagire et al. ; Beritelli and Laesser ; Gray 2004; Wondolleck et al. 2003).

The consequences of lack of shared communication, knowledge and appreciation of socio-political context has led to pig management policy that fails to achieve its management goals. This is a common occurrence in the presence of complex natural resource management

systems. Gadgil et al.(1993) suggest that, in the presence of more complex ecological systems, more positivistic methods are often unable to cope with the large variations of temporal and spatial scales and generalizations arrived at by scientific knowledge fail to account for practical sustainable resources use. Ecological systems thus tend to be over simplified and can lead to resource exhaustion and degradation of the environment. There is a tendency to focus on the use of biological characteristics to make management decisions with little consideration of resource users (Gadgil et al. 1993). Participatory programs that incorporate multiple stakeholder groups can allow policymakers to better understand stakeholder needs and gather the necessary information for creating more effective management policy (Berkes and Folke 2000; Firey 1960; Gibson and Marks 1995; Holling 1973; Janssen 2011; Parson and Shils 1951).

The evaluation of social structures provides critical insight into conflict and the evaluation of resource use, but implementation of social structure analysis can also contribute both to overcoming stereotypes between stakeholders and forging new relationships. It can be used to avoid conflict or assist in overcoming it. The analysis of social structures can provides strategies for penetrating communication barriers and improving communication practices.

Conclusions: Working Beyond Stereotypes

There is a need for stakeholders to see beyond the stereotypes they create for each other; to banish illusory barriers so that it is easier to address actual management barriers. This change can be initiated by consideration of social context, and the ability to understand the relevance of contextual differences based on mutual awareness skills, the reframing of conflict to focus on shared perspectives, and introducing better communication pathways. The use of social structure is important to all these concepts.

The acknowledgement of differences in social context exposed through the analysis of social structures, such as differing knowledge systems and differences in the uses of power, are important considerations for improving natural resource management conditions. For example, when determining which stakeholders are important to the management of a natural resource issue, it is useful to be aware that there may be 'silent' stakeholders. The voice of some stakeholders may not be widely heard, but that does not mean they are not concerned about a management issue. This is the case with TOs interested in feral pig management. Their silence may in part be the result of a sense of exclusion from the pig management arena. When managing a resource it is important to brainstorm and consider which stakeholders are directly touched by changes to the resource and to connect with them either directly or through the use of appropriate media resources.

It is helpful to consider a system for managers to better integrate the concerns of differing social structures. Mutual awareness can help open opportunities for reframing and for making participants more open to change. The requirement of special training for managers or the recruitment of managers who already have the skill of mutual awareness may be beneficial. It is not sufficient to have a select few managers with this skill. It needs to become part of the whole manager social structure, because any manager involved in decision-making requires this ability. Amongst the managers I interviewed, there was one in particular that stood out as having this ability. The structure in which he functioned somewhat restrained his ability to act on his perceptions, but other stakeholders who were in contact with this manager also described him as having this ability, as being approachable, flexible, open to management suggestions and understanding his position and that of others. He had social capital in the community and was also respected by other managers for his actions and work in his field.

As opposed to the manager described above, another manager had very little mutual awareness, held little social capital in the community where he worked and this may have contributed to the failure of one of the local management programs. Both Manager and FHT members could benefit from representatives that have this attribute of mutual awareness. There are some FHT members that already serve as representatives of their social structure. They possess this attribute and are respected in non-FHT circles for their ability to express their own community needs as well as understanding other perspectives. In order for the attribute of mutual awareness to be fully implemented in management practice however, there is a need for more flexible legislation and policy created at the state and federal levels (see Chapter 4). For example, in the study examining participatory management of the sooty owl in Oregon and amongst diverse stakeholders, Wondolleck and Yaffee (2000) described how the presence of flexible governance systems is essential to successful collaborative adaptive management outcomes. The assessment of stakeholder social structures by managers creates opportunities to develop mutual awareness and it can assist in the dissolution of negative stereotypes and illusory barriers.

It is necessary for stakeholder groups involved in different social structures to concretize essential management terms together. In the case of pig management, this includes the creation of an operational definition describing significant pig damage based on stakeholder perceptions of damage in urban, rural, and protected areas, and overall for the CCRC area. It is also beneficial to explore what could be acceptable management strategies and methods to control pigs; is it best to follow a precautionary principle or a cost-benefit analysis approach based on available management resources? The long-term sustainability of management must also be considered.

In the process of overcoming conflict, it is also useful for participants to focus on their mutual values and goals as a starting point for management rather than focus on their differences. All participants find the implementation of pig control programs to be acceptable. There are shared values about management methods as well (Chapter 2). If these stakeholders also work together, it is possible for them to pool their limited management resources and create more effective management actions. It might also serve to create a program that is better able to manage access issues.

The value of reframing conflict from combative to cooperative has previously been affirmed. One example of this kind of reframing is the case of the Applegate Watershed in Oregon, USA (Wondolleck et al. 2003; Wondolleck and Yaffee 2000). During the spotted owl debate of the 1980s, a mix of stakeholders, including farmers, ranchers, US forest service employees, loggers and ecologists, fought in the courtroom over the issue. Eventually, participants chose to deliberately reframe their positions, to act on the elements that united them as a community rather than the identity issues that divided them. One of the tools that assisted in creating this accord was the development of a group vision statement. Ultimately, they were able to work together to make decisions about management of this species (Wondolleck et al. 2003; Wondolleck and Yaffee 2000). Similarly, the shared values of stakeholders in the CCRC area can provide a foundation on which they can build a shared pig management program.

Another example of reframing an intractable conflict comes from the management of the Galapagos Marine Reserve (Heylings and Cruz 1998), where multiple stakeholder disputes involving tourism operators, park users, conservationist, local and international fishers, and government officials have long existed around the unregulated industrial fishing industry. Added to the mix, the various park management authorities were unable to coordinate their management

areas and did not have the resources to enforce park regulations. The outcome of this conflict has ultimately been a decline in sea-cucumber and shark populations due to illegal fishing of these species by international fishers for sale in Asian markets.

In 1995, violent protests led government officials to realize that policing the conflict would be increasingly costly. In the end a consultant was called; stakeholders had been focused on their own interests, which divided the groups. The consultant reframed the conflict to focus the debate on the common problem shared by the local stakeholder groups; the exclusion of local stakeholders from marine management processes and the sense of imposed and ineffective regulations. Through the use of outside mediation and the initiation of participatory planning among local stakeholders (excluding international fishers), the government and local stakeholders were enabled to devise a new management direction which helped to ease the conflict. This new management process also served to initiate reframing of identity and characterization frames, through the validation and acknowledgment of local stakeholder knowledge and sense of ownership of the park (Heylings and Cruz 1998). In both these examples, reframing the management problem by approaching resource challenges with a shared understanding of the management issue, the use of inclusive participatory methods, and an external mediator helped to defuse existing conflict.

The use of some action research methodology could improve communicative interactions between social structures. For example, the development of feedback loops, encouraging participation in management/research planning as was employed in this study. Search conferences offer forums in which to explore the positions of stakeholder groups. A search conference is a group meeting held with all interested participants to discuss participatory methods for collective planning and action design for solving problems relevant to the people

involved (Emery and Purser 1996; Greenwood and Levin 1998; Rehm et al. 2002). This kind of communicative interaction can encourage flexibility within the socio-political system.

Search conferences allow new channels in which stakeholders can connect and promote greater accountability and transparency between stakeholders which are essential to conflict resolution. For example, a search conference was used to facilitate the management of double-crested cormorants (*Phalacrocorax auritus*) in New York (Schusler and Decker 2002). The management of these species was suffused in conflict with tourism operators and birders and environmentalists clashing in regards to the need to protect this species after a population boom. After the conference, local stakeholders particularly noted an appreciation of the shared action planning process, a sense of increased understanding of other stakeholder positions, and many were surprised to learn about the degree of shared management perspectives between stakeholders. The conference provided stakeholders with the opportunity to share their perspectives and begin to move toward a shared perspective that could ultimately serve to facilitate collaboration in the management of the cormorants (Schusler and Decker 2002).

Search conferences can provide an opportunity for managers to demonstrate an interest in the position of FHT members, particularly if managers are willing to consider stakeholder concerns. As in the owl controversy, mediation may be necessary when conflict is intractable to create an environment that is open to communication (Wondolleck and Yaffee 2000). Also, in addition to group meetings of stakeholders, some individual meetings are useful to prevent the loss of information from key stakeholders who are uncomfortable with voicing their opinions in such an environment. If stakeholders can be moved from positions of defending identity to positions of negotiating together around the pertinent management issues, management might become more successful (Buckles and Rusnak 1999).

The strategies described in this section for improving stakeholder conflict could be used in conjunction with social structure analysis to both defuse stereotypes, but also to establish trust and build social capital between stakeholders. These strategies can help create new arenas with new language in which different social structures can function together. The tensions and sources of conflict between the stakeholder groups described in the case of feral pig management in CCRC are not only relevant to the management of feral pigs in the region; the repair of the social relationships would improve not only the functionality and management of pigs, but would create a less conflicted arena in which to address other regional natural resource management issues. The applicability of addressing socio-political conflict with the assistance of social structure analysis also goes beyond the CCRC. While the details may vary, these kinds of issues are widely relevant to any kind of natural resource management issue.

Literature Cited

Abreu, J. 2001. Theory and Research on Stereotypes and Perceptual Bias: A Didactic Resource for Multicultural Counseling Trainers. The Counseling Psychologist 29:487-512.

Adams, C. E., B. J. Higginbotham, D. Rollins, R. B. Taylor, R. Skiles, M. Mapston, and S. Turman. 2005. Regional perspectives and opportunities for feral hog management in Texas. Wildlife Society Bulletin 33:1312-1320.

Adams, J. S., and T. O. McShane 1992. The Myth of Wild Africa: Conservation Without Illusion. University of California Press, NY.

Alston, L., B. Mueller, C. Menard, and M. Shirley. 2005. Property Rights and the State Handbook of New Institutional Economics. Pages 573-590. Springer US.

Bagire, V. A., I. Tusiime, G. Nalweyiso, and J. B. Kakooza. 2011. Contextual environment and stakeholder perception of corporate social responsibility practices in uganda. Corporate Social Responsibility and Environmental Management 18:102-109.

Bateson, G. 1972. Steps toward an ecology of mind. Ballantine New York.

Bauer, J., and J. Giles. 2002. Recreational Hunting an International Perspective Wildlife Tourism Research Report Series: No. 13: Status Assessment of Wildlife Tourism in Australia Series. CRC for Sustainable Tourism Pty Ltd, Australia.

Benford, R. D., and D. A. Snow. 2000. Framing processes and social movements: an overview and assessment. Annual Review of Sociology 26:611.

Benford, R. D., and D. A. Snow. 2005. Clarifying the relationship between framing and ideology. Pages 205-211 in H. Johnston, Noakes, John A. , editor. Frames of protest: social movements and the framing perspective. Rowman & Littlefield Publishers, Inc., Oxford, UK.

Beritelli, P., and C. Laesser. 2011. Power dimensions and influence reputation in tourist destinations: Empirical evidence from a network of actors and stakeholders. Tourism Management 32:1299-1309.

Berkes, F. 1999. Sacred ecology: traditional ecological knowledge and resource management. Taylor and Francis, Philadelphia.

Berkes, F., J. Colding, and C. Folke. 2000. Rediscovery of Traditional Ecological Knowledge as Adaptive Management. Ecological Applications 10:1251-1262.

Berkes, F., and C. Folke 2000. Linking Social and Ecological Systems. Cambridge University Press, Cambridge, UK.

Bernard, H. R. 2000. Social Research Methods: Qualitative And Quantitative Approaches. Sage Publications, Inc., Thousand Oaks, CA.

Bernard, H. R. 2006. Research Methods In Anthropology: Qualitative And Quantitative Approaches. AltaMira Press, NY, NY.

Blaikie, P., K. Brown, M. Stocking, L. Tang, P. Dixon, and P. Sillitoe. 1997. Knowledge in Action: Local Knowledge as a Development Resource and Barriers to its Incorporation in Natural Resource Research and Development. Agricultural Systems 55:217-237.

Bomford, M., and J. Caughley 1996. Sustainable Use of Wildlife by Aboriginal Peoples and Torres Strait Islanders. Australian Government Publishing Services, Canberra, ACT.

Booth, W. C., G. G. Colomb, and J. M. Williams 1995. The Craft Of Research. University of Chicago Press, Chicago, IL.

Bourne, L., and D. H. T. Walker. 2005. Visualising and mapping stakeholder influence. Management Decision 43:649-660.

Brynn, P. S. 2007. Relationship outcomes as determinants of reputation. Corporate Communications: An International Journal 12:376-393.

Buckles, D. 1999. Cultivating Peace: Conflict and Collaboration in Natural Resource Management. International Development Research Centre & World Bank, ON, Canada.

Buckles, D., and G. Rusnak. 1999. Conflict and Collaboration in Natural Resource Management. Pages 1-10 in D. Buckles, editor. Cultivating Peace: Conflict and Collaboration in Natural Resource Management. International Development Research Centre & World Bank, ON, Canada.

Butler, J. R. A. 2011. The challenge of knowledge integration in the adaptive co-management of conflicting ecosystem services provided by seals and salmon. Animal Conservation 14:599-601.

Cardenas, J.-C., and E. Ostrom. 2004. What do people bring into the game? Experiments in the field about cooperation in the commons. Agricultural Systems 82:307-326.

CCRC. 2011. Tropical Futures 2016: Pillars For A Sustainable Cassowary Coast. Pages 1-52, Innisfail, Qld.

Chugh, D. 2004. Societal and Managerial Implications of Implicit Social Cognition: Why Milliseconds Matter. Social Justice Research 17:203-222.

Crookes, D., and I. Thomas. 1998. Problem solving and culture - exploring some stereotypes. Journal of Management Development 17:583-591.

D'Angelo, P. 2002. News Framing as a Multiparadigmatic Research Program: A Response to Entman. Journal of Communication 52:870-888.

Department of Sustainability, E., Water, Population and Communities 2011. The feral pig (*Sus scrofa*), Canberra, ACT.

Dewulf, A., B. Gray, L. Putnam, R. Lewicki, N. Aarts, R. Bouwen, and C. van Woerkum. 2009. Disentangling approaches to framing in conflict and negotiation research: A meta-paradigmatic perspective. Human Relations 62:155-193.

Dietz, T., E. Ostrom, and P. C. Stern. 2003. The Struggle to Govern the Commons. Science 302:1907-1912.

Douglas, L., A. Roberts, and R. Thompson 1988. Oral History: A Handbook. Allen and Unwin Australia Pty Ltd, Sydney, NSW.

Dreyfus, H. L., P. Rabinow, and M. Foucault 1983. Michel Foucault, Beyond Structuralism and Hermeneutics. University of Chicago Press, Chicago, IL.

Dwyer, P. D. 2006. People, pigs and parasites in New Guinea: Relational contexts and epidemiological possibilities. Parasitology International 55:S167-S173.

Emery, M., and R. Purser 1996. The search conference: a powerful method for planned organizational change and community action. Jossey-Bass Publisher, San Francisco, CA.

Entman, R. M. 1993. Framing: toward clarification of a fractured paradigm. Journal of Communication 43:51-58.

Felt, L. F. 2005. You can't eat "paper fish": recent attempts to link local ecological knowledge and fisheries science in atlantic Canada. Pages 223-252 in A. Herda-Rapp, and T. L. Goedeke, editors. Mad About Wildlife. Koninklijke Brill NV, Leiden, The Netherlands.

Finlayson, A. C., and B. J. McCay. 1998. Crossing the threshold of ecosystem resilience: the commercial extinction of northern cod. Pages 311-337 in F. Berkes, and C. Folke, editors. Linking social and ecological systems: management practices and social mechanisms for building resilience. Cambridge University Press, Cambridge, UK.

Firey, W. I. 1960. Man, Mind and Land: A Theory Of Resource Use. Free Press, Glencoe, Il.

Forgas, J. P., and K. D. Williams 2001. Social Influence: Direct and Indirect Processes. Psychology Press, Philidelphia, PA.

Foucault, M. 1972. The archaelogy of knowledge. Routledge, London.

Foucault, M. 1980. Power/Knowledge:selected interviews and other writings by Michel Foucault, 1972-1977. Harvester, Brighton, England.

Gadgil, M., F. Berkes, and C. Folke. 1993. Indigenous Knowledge for Biodiversity Conservation. Ambio 22:151-156.

Gardner, G. T., and P. C. Stern 2002b. Environmental problems and human behavior Pearson Custom Publishing, Boston, MA.

Gibson, C. C., and S. A. Marks. 1995. Transforming Rural Hunters into Conservationists: An Assessment of Community-Based Wildlife Management Programs in Africa. World Development 23:941-957.

Girringun Aboriginal Corporation. 2012. About Us: What is Girringun?, Cardwell, QLD.

Goffman, E. 1959. The presentation of self in everyday life. Doubleday, Garden City, N.Y.

Gray, B. 2003. Framing of Environmental Disputes. Pages 11-34 in R. Lewicki, B. Gray, and M. Elliot, editors. Making Sense of Intractable Environmental Conflicts: Concepts and Cases. Island Press, Washington, D.C.

Gray, B. 2004. Strong opposition: frame-based resistance to collaboration. Journal of Community & Applied Social Psychology 14:166-176.

Greenwood, D. J., and M. Levin 1998. Introduction to Action Research: Social Research for Social Change. Sage Publications, Inc., , Thousand Oaks, CA.

Habermas, J. 1975. Legitimation Crisis. Beacon, Boston.

Habermas, J. 1984. The theory of communicative action. Heinemann, London.

Habermas, J. 1987. Between Facts and Norms. Polity, Oxford.

Hall, S., editor. 1997. Representation: cultural representations and signifying practices. Sage Publications, Ltd., London, UK.

Hanneman, R. A., and M. Riddle. 2005. Introduction to social network methods. University of California, Riverside Riverside, CA.

Hardin, G. 1968. The Tragedy of the Commons. Science 162:1243-1248.

Helm, S. 2007. One reputation or many? Corporate Communications: An International Journal 12:238-254.

Helmke, G., and S. Levitsky. 2004. Informal Institutions and Comparative Politics: A Research Agenda. Perspectives On Politics 2:725-740.

Henzell, T. 2007. Australian agriculture: its history and challenges. CSIRO Publishing, Collingwood, Victoria.

Herr, K., and G. L. Anderson 2005. The action research dissertation: A guide for students and faculty. Sage, Thousand Oaks, CA.

Heylings, P., and F. Cruz. 1998. Common Property, Conflict, and Participatory Management in the Galapagos Islands in IASC, editor. Crossing Boundaries, the Seventh Biennial Conference of the International Association for the Study of Common Property, Vancouver, British Columbia, Canada.

Hide, R. 2003. Pig husbandry in New Guinea: A literature review and bibliography. Page 209 in A. Monograph, editor. Australian Centre for International Agricultural Research, Canberra.

Holling, C. S. 1973. Resilience and stability of ecological systems. Annu Rev Ecol Syst 4:1-23.

Iavicoli, S., E. Natali, P. Deitinger, B. Maria Rondinone, M. Ertel, A. Jain, and S. Leka. Occupational health and safety policy and psychosocial risks in Europe: The role of stakeholders' perceptions. Health policy 101:87-94.

Izac, A. M. N., and P. O'Brien. 1991. Conflict, uncertainty and risk in feral pig management Australian approach. Journal of Environmental Management 32:1-18.

Janssen, M. 2011. Resilience and adaptation in the governance of social-ecological systems. International Journal of the Commons Vol 5:340-345.

Jiang, J. J., G. Klein, S. P. J. Wu, and T. P. Liang. 2009. The relation of requirements uncertainty and stakeholder perception gaps to project management performance. The Journal of Systems & Software 82:801-808.

Johannes, R. E. 1981. Words of the lagoon:fishing and marine lore in Palau District of Micronesia. University of California, Press, Berkely, CA.

Johannes, R. E. 1989. traditional ecological knowledge: a collection of essays. IUCN, Cambridge.

Johannes, R. E., M. M. R. Freeman, and R. J. Hamilton. 2000. Ignore fishers' knowledge and miss the boat. Fish and Fisheries 1:257-271.

Johnston, H., and S. Lio. 1998. Collective behavior and social movements in the postmodern age: Looking backward to look forward. Sociological Perspectives 41: 453-472.

Johnston, H., and P. E. Oliver. 2005. Breaking the frame. Pages 213-216 in H. Johnston, Noakes, John A. , editor. Frames of protest: social movements and the framing perspective. Rowman & Littlefield Publishers, Inc., Oxford, UK.

Kant, S., and R. Cooke. 1999. Jabalpur District, Madhya Pradesh, India: Minimizing conflict in joint forest management in D. Buckles, editor. Cultivating Peace: Conflict and Collaboration in Natural Resource Management. International Development Research Centre & World Bank, ON, Canada.

Katz, N., D. Lazer, H. Arrow, and N. Contractor. 2004. Network Theory and Small Groups. Small Group Research 35:307-332.

Kellert, S., J. Mehta, S. Ebbin, and L. Lichtenfeld. 2000. Community Natural Resource Management: Promise, Rhetoric, and Reality. Society & Natural Resources 13:705-715.

Ko, S. J., D. Muller, C. M. Judd, and D. A. Stapel. 2008. Sneaking in through the back door: How category-based stereotype suppression leads to rebound in feature-based effects. Journal of Experimental Social Psychology 44:833-839.

Lauth, H.-J. 2000. Informal institutions and democracy. Democratization 7:21-50.

Lewicki, R., B. Gray, and M. Elliot, editors. 2003. Making Sense of Intractable Environmental Conflicts: Concepts and Cases. Island Press, Washington, D.C.

Lippman, W. 1921. Public Opinion. Harcourt Brace Jovanovich, New York

MacGaffey, J., and R. Bazenguissa-Ganga 2000. Congo-Paris: Transnational Traders On The Margins Of The Law. Indiana University Press, Bloomington, Indiana.

Maguire, L. A. 2004. What Can Decision Analysis Do for Invasive Species Management? Risk Analysis 24.

Markovsky, B., and E. J. Lawler. 1994. A new theory of group solidarity. Pages 113-137 in B. Markovsky, K. Heimer, and J. O'Brien, editors. Advances in group processes, Greenwich, CT.

Matthes, J. R. 2009. What's in a frame? A content analysis of media framing studies in the world's leading communication journals, 1990-2005. Journalism & Mass Communication Quarterly 86:349-367.

McCarty, C., J. Molina, x00E, Luis, C. Aguilar, and L. Rota. 2007. A Comparison of Social Network Mapping and Personal Network Visualization. Field Methods 19:145-162.

McCay, B. J. 1996. Common and private concerns. Pages 111-126 in S. S. Hanna, C. Folke, and K.-G. Mäler, editors. Rights to nature: ecological, economic, cultural, and political principles of institutions for the environment. Island Press, Washington, D.C.

McGaw, C. C., and J. Mitchell. 1998. Feral Pigs (Sus scrofa) In Queensland in Department Of Natural Resources And Mines, editor. Pest Status Review Series-Land Protection, QLD.

McGregor, J. 2000. Stereotypes and symbolic annihilation: press constructions of women at the top. Women in Management Review 15:290-295.

Medin, D., N. Ross, D. Cox, and S. Atran. 2007. Why Folkbiology Matters: Resource Conflict Despite Shared Goals and Knowledge. Human Ecology 35:315-329.

Miles, M. B., and A. M. Huberman 1994. Qualitative Data Analysis: An Expanded Sourcebook. SAGE Publications, Inc Thousand Oaks, CA.

Mills, J., Y. Chapman, A. Bonner, and K. Francis. 2007. Grounded theory: a methodological spiral from positivism to postmodernism. Journal of Advanced Nursing 58:72-79.

Minsky, M. 1975. A framework for representing knowledge. Pages 211–277 in McGraw-Hill, editor. The psychology of computer vision. Winston, P.H., New York.

Morgan, D. L. 1997. Focus Groups As Qualitative Research. Sage Publications, Inc., London.

Morgan, M., J. Sanchez, C. A. Brebbia, and A. Voiskounsky 2004. Human Perspectives in the Internet Society: Culture, Psychology and Gender. WIT Press, UK.

Mosse, D. 2004. Power relations and poverty reduction. Pages 51-67 in R. Alsop, editor. Power, rights and poverty: concepts and connections The World Bank, Washington, DC.

Noble, K. 1996. Sustainable best practice feral pig management in Queensland wet tropics: Final Report To The Vertebrate Pest Program, Townsville, Australia.

O'Brien, P. H. 1987. Socio-economic and biological impact of the feral pig in New South Wales: An overview and alternative management plan. The Australian Rangeland Journal 9:96 – 101.

Oliver, P. E., and H. Johnston. 2005. What a good idea! Ideologies and frames in social movement research. Pages 185-203 in H. Johnston, Noakes, John A. , editor. Frames of protest: social movements and the framing perspective. Rowman & Littlefield Publishers, Inc., Oxford, UK.

Ostrom, E. 1990. Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press, Cambridge,MA.

Ostrom, E. 1998. A behavioral approach to the rational choice theory of collective action presidential address, American Political Science Association, 1997. The American Political Science Review 92:1-22.

Ostrom, E. 1999. Coping with tragedies of the commons. Annual Review of Political Science 2:493.

Ostrom, E. 2000. Collective Action and the Evolution of Social Norms. Journal of Economic Perspectives 14:137-158.

Pandey, S. K., and E. W. Welch. 2005. Beyond Stereotypes. Administration & Society 37:542-575.

Parson, T., and E. Shils 1951. Toward A General Theory Of Action. Harvard University Press, MA.

Parsons, T. 1968. The Structure of Social Action. The Free Press, New York.

Portelli, A. 1998. What Makes Oral History Different. Pages 63-74 in R. Perks, and A. Thompson, editors. The Oral History Reader. Routlege, NY.

Rabinow, P., editor. 1984. The Foucault Reader. Pantheon Books New York

Rehm, R., N. Cebula, F. Ryan, and M. Large 2002. Futures that work: using search conferences to revitalize companies, communities, and organizations. New Society Publishers, Gabriola Island, BC, Canada.

Roberts, A., N. Klomp, and J. Birckhead. 1996. Monitoring marine and terrestrial hunting in an Aboriginal community in North Queensland. Pages 152-168 in M. Bomford, and J. Caughley, editors. Sustainable Use of Wildlife by Aboriginal Peoples and Torres Strait Islanders. Australian Government Publishing Services, Canberra, ACT.

Robertson, H. A., and T. K. McGee. 2003. Applying local knowledge: the contribution of oral history to wetland rehabilitation at kanyapella Basin, Australia. Journal of Envionmental Management 69:275-287.

Rothbart, M. 1981. Memory processes and social beliefs. Pages pp. 145-181 in D. L. Hamilton, editor. Cognitive processes in stereotyping and intergroup behavior Lawrence Erlbaum, Hillsdale, NJ.

Russell, D., and C. Harshbarger 2003. Groundwork For Community-Based Conservation: Strategies For Social Research. Altamira Press, , Walnut Creek, CA.

Rydin, Y. 2003. Conflict, Consensus, And Rationality In Environmental Planning: An Institutional Discourse Approach. Oxford University Press, New York.

Satir, V. 1972. Peoplemaking. Science and Behavior Books, Palo Alto.

Schaller, M., and L. G. I. Conway. 1999. Influence of Impression-Management Goals on the Emerging Contents of Group Stereotypes: Support for a Social-Evolutionary Process. Personality and Social Psychology Bulletin 25:819-833.

Scheff, T. J. 2005. The Structure of Context: Deciphering Frame Analysis. Sociological Theory 23:368-385.

Scheff, T. J. 2007. A Concept of Social Integration. Philosophical Psychology 20:579-593.

Schon, D. A., and M. Rein 1994. Frame Refelection. Basic Books, New York, NY.

Schusler, T., and D. J. Decker. 2002. Engaging local communities in wildlife management area planning: an evaluation of the Lake Ontario Islands search conference. Wildlife Society Bulletin 30:1226-1237.

Sharp, R., and K.-U. Wollscheid. 2009. An Overview of Recreational Hunting in North America, Europe and Australia. Pages 25-38. Recreational Hunting, Conservation and Rural Livelihoods. Wiley-Blackwell.

Shriver, T. E., and C. Peaden. 2009. Frame Disputes in a Natural Resource Controversy: The Case of the Arbuckle Simpson Aquifer in South-Central Oklahoma. Society & Natural Resources 22:143-157.

Sillitoe, P. 2001. Pig Men And Women, Big Men And Women: Gender And Production In The New Gunea Highlands. Ethnology 40:171.

Simmons, A. 1993. A Preliminary Aboriginal Cultural Heritage Survey of the Wet Tropics World Heritage Area, Innisfail District, Innisfail, QLD.

Sommer, B., and M. Quinlan 2002. The Oral History Manual. Altamira Press, CA.

Steins, N. A., and V. M. Edwards. 1999. Platforms for collective action in multiple-use common-pool resources. . Agriculture and Human Values 16:241–255.

Strauss, A., and J. Corwin 1990. Basics Of Qualitative Research: Grounded Theory Procedures And Techniques. Sage Publications, Inc., Newbury Park, CA.

Takahashi, S., and C. A. Tisdell. 1989. The trade in wildlife pig meat; Australia and Japan. The Australian Geographer 20:88-94.

Thompson PM, M. B., Barton TM, Duck C, Butler JRA. 2007. Assessing the potential impact of salmon fisheries management on the conservation status of harbour seals (Phoca vitulina) in north-east Scotland. Animal Conservation 10:48–56.

Tisdell, C. A. 1982. Wild Pigs: Environmental Pest or Economic Resource? . Pergamon Press Sydney.

Townley, B. 1993. Foucault, Power/Knowledge and its relevance for human resource mangement. Academy of Management Review 18:518-545.

Tsachalidis, E. P., and E. Hadjisterkotis. 2008. Wild boar hunting and socioeconomic trends in Northern Greece, 1993-2002. European Journal of Wildlife Research 54:643-649.

Wasserman, S., and K. Faust 2007. Social Network Analysis: Methods and Applications. Cambridge University Press, NY,NY.

Willis, H. H., and M. L. DeKay. 2007. The Roles of Group Membership, Beliefs, and Norms in Ecological Risk Perception. Risk Analysis 27:1365-1380.

Wolf, A. T. 1998. Conflict and cooperation along international waterways. Water Policy 1:251-265.

Wondolleck, J. M., B. Gray, and T. Bryan. 2003. Us versus Them: How Identities and Characterizations Influence Conflict. Environmental Practice 5:207-213.

Wondolleck, J. M., and S. L. Yaffee 2000. Making Collaboration Work: Lessons from Innovation in Natural Resource Management. Island Press Washington,DC.

Young, J., J. Butler, A. Jordan, and A. Watt. 2012. Less government intervention in biodiversity management: risks and opportunities. Biodiversity and Conservation 21:1095-1100.

Yow, V. 1994. Recording Oral History: A Practical Guide for Social Scientists. Sage Publications, Inc., CA.

Chapter 4

Killing Paper Parks And Paper Pigs: Ecological Resilience And Participation In Socio-Ecological Systems

Introduction

Feral pigs are a multiple use resource that has diverse impacts on wildlife and plant ecology, economic, health, and social sectors. There is a large and heterogeneous group of stakeholders interested in their management, yet there are few studies that examine feral pig management strategies through the lens of multiple stakeholder perspectives. For some stakeholders, pigs are considered a pest species to be eradicated due to the damage they can cause to agricultural lands and biodiversity. For example, in Texas, USA, managers and landowners were generally in agreement that pigs cause significant damage and all these stakeholders undertook some measure of pig control (2005). To other stakeholders, while they may acknowledge that pigs can cause some damage to the landscape, the overall benefits afforded by this species in economic, cultural, and recreational value outweigh the ecological costs.

In Papua New Guinea, for example, pigs are known to be an important part of many cultural practices (Dwyer 2006; Hide 2003). Pigs are used as bridal gifts, at initiation ceremonies, and other rituals. Feral pig stocks are domesticated or hunted outright. Populations are carefully managed to prevent extinction (Dwyer 2006; Hide 2003). In Hawaii, multiple stakeholders contend over the use of pigs (Maguire 2004). Managers strive to reduce pig populations because of the damage they are perceived to cause to wildlife and habitat, while native Hawaiians consider the hunting and consumption of pigs to be an important cultural tradition and wish to maintain sufficient pig populations for these activities. State managers of

game lands try to control pig populations rather than destroy them and animal rights advocates are concerned with some of the methods used to capture and kill pigs.

In Australia, pigs have become an increasingly important management issue. Today, there may be as many as 23.5 million pigs inhabiting approximately half of Australia (Department of Sustainability 2011). Feral pigs are described by the scientific literature as competitors, scavengers, and predators of native wildlife sharing the same food sources with species such as cassowaries (*Casuarius Spp.*), while also consuming the eggs of ground nesting birds and turtles, and consuming a number of species themselves including endangered frog species and cassowary chicks (Crome and Moore 1988; McGaw and Mitchell 1998). Pigs are also considered seed predators and dispersers and can destroy and damage plants through consumption and foraging activities (McGaw and Mitchell 1998; Twigg et al. 2007).The damage to agriculture is estimated to cost Australia at least AUS$100 million per year (Choquenot et al. 1996). There are also concerns about the spread of disease from pigs to livestock or humans (Animal Health Australia 2005; Hone 2002; Pavlov 1988).

Pigs are considered a beneficial resource to hunters. Indigenous hunters may use pig hunting as a way to maintain traditional hunting practices, and pig meat is only hunted for consumption and use for ritual purposes (Roberts et al. 1999). Recreational hunters track pigs for multiple reasons including from a sense of adventure, to connect with nature, and to maintain and create new relationships (Bauer and Giles 2002; Mason and Fleming 1999; Tisdell 1982). There are also economic benefits from hunting. In 1984, approximately two million kg of pig meat were exported with an export value of about AUS$10 million. The hunting of pigs in general also provides revenues to weapon wholesalers, hunting outfitters, and hunting magazines and literature. It has been suggested that pig hunters spend between 5 to15 million Australian

dollars a year on their hunting activities (Tisdell 1982). The management of pigs however, is fraught with conflict, which is partly a consequence of the presence of multiple stakeholders with diverse views of resource use, but also due to the complexity of the management of the pig resource itself (Campbell and Long 2009; Choquenot et al. 1996; McGaw and Mitchell 1998; Mcllroy 1993).

Feral pigs are not effectively managed. Federal and state legislation exists requiring their management, but on-ground practice either does not always follow this policy or else is ineffective in its goals of controlling this natural resource (Izac and O'Brien 1991; Tisdell 1982; Zivin et al. 2000). As disparate as they seem, the same concepts that describe the management of a multiple use resource such as feral pigs, are at play in the management of paper parks. 'Paper parks' or 'threatened protected areas' refer to areas that are designated as protected only through legislation; there is little or no on-ground management of the parks which results in a failure to meet biodiversity conservation goals for their care (Adams and McShane 1996; Bonham et al. 2008; De Santo 2012). It has been estimated that in 1999, in 10 developing countries, less than 25% of protected areas were effectively managed and that more than 10% of protected areas were already extensively degraded (Dudley and Stolton 1999). This study adopts the term 'threatened protected areas' (TPAs) due do the stigma associated with the phrase 'paper parks'. Criticism made of the term paper parks suggests that the term undermines and belittles the efforts of managers and so has caused resentment from managers of protected areas. This is particularly the case for managers who have worked hard to get an area legally protected, but where very limited resources are available for the maintenance of these areas (Carey et al. 2000). The term TPAs was coined in an effort to acknowledge and respect the efforts and knowledge of managers who work daily to sustain our natural resources (Carey et al. 2000).

There are many reasons suggested for the presence of TPAs; for example, De Santo (2012) proposed that the need to meet international conservation targets, such as climate change targets, has resulted in dramatic extensions of marine protected areas (MPAs) (e.g., there has been a 60% increase in global MPAs since 2007) and that the designation of these areas has outstripped managers' abilities to protect these areas. The existence of TPAs represents a lack of capacity to manage these parks because of factors that include: lack of funding, poor staffing and infrastructure, poor relationship with local communities, and differences in opinion about the value of the resource or its management either within the area or in the area adjoining the TPAs (Carey et al. 2000; De Figueiredo 2007). Carey et al. (2000) describe three key underlying causes for TPAs at the global level: high global consumption of resources and pressure from economic sectors, regular expansion of development and trade practices, and externalities caused by poverty. Some other suggested underlying causes of paper parks include social processes and factors such as: cultural (e.g., beliefs and values), policy and institutional (e.g., formal policy, policy context, and property rights), demographic (migration and population density), economic (economic infrastructures and market changes), and technological (agricultural technology changes and application of technology; Bonham et al. 2008; Folke 2006; Geist and Lambin 2002; Jentoft et al. 2007).

The scientific literature is in general agreement that effective park management requires the integration of participation to address some of the underlying causes of management failure and that there has been a trend for change from a traditional top down approach in management of parks, to what is referred to as community based approaches that are considered more participatory (Akbulut ; Bihari and Ryan ; Bonham et al. 2008; Brosius and Russell 2003; Christensen 2004; Luyet et al. ; Rodela). The more participatory methods, however, have

sometimes also met with limited success and one well known example is the failure of many Integrated Conservation Development Projects (Adams and McShane 1996; Averbeck 2006; Berkes and Folke 2000; Bonham et al. 2008; Brosius and Russell 2003). The question remains, why do some of these programs fail and how do they contribute to the failure of TPAs?

While several studies have attempted to provide an overview of the underlying causes of TPAs, they do not evaluate in detail the internal causes of TPAs within the management system that lead to the inability of these parks to thrive. The question for both paper parks and multiple use resources such as feral pigs remains- why does this failure occur and how can we manage these resources more effectively? Current literature on TPAs only provides a partial answer to this question. The examination of the socio-ecological system of feral pig management provides additional insight into the subject.

The Wet Tropics of Far North Queensland (FNQ) is estimated to hold as much as 75% of Queensland's pig populations partly because their needs for a regular source of water and habitat cover are easily met (McGaw and Mitchell 1998). The present study examines feral pig management in the Cassowary Coast Regional Council of FNQ. The purpose of this paper is to evaluate the impact of resilience and participation practices on the management of a socio-ecological system and discuss the relevance of these findings to the management of TPAs. Specifically, this study examines strategies employed for the management of pigs, the inherent philosophies behind these strategies, and how these two factors influence the management of this complex resource. The primary stakeholders participating in this study are farmers, hunters, and also traditional land owners and managers. This study uses the Gray (2003) method for frame analysis of environmental disputes, which can provide an arena in which to evaluate the components of complex environmental management issues. Through this examination, it is

possible to then reframe contentious issues in order to encourage more positive management outcomes.

Literature Review

The complexity of the feral pig resource system is best understood through the examination of the socio-ecological system of which it is a part, as well as, through a review of the legislation and previous management programs devised for pig control.

Socio-Ecological Systems And Complexity

Feral pig management poses a particularly complex management issue, because unlike resources such as minerals and lumber, pigs are a regularly moving resource. The challenges associated with the management of pigs are most similar to those found in water economics, where management issues revolve not just around who uses the resource and how, but where it can be used and managed.

The successful management of natural resources requires a clear understanding of the socio-ecological system of which it is a part. This system consists of the resource and the social system that frames the ways in which the resource is used. An understanding of the socio-ecological system can provide a holistic view of the components and interactions among the elements that compose it (Berkes and Folke 2000; Firey 1960; Gibson and Marks 1995; Marks 1984). Social systems that consider society as a whole depend on the availability of natural resources to function and evolve (Roacher 1975). It is only at the point natural resources and the social system intersect that stakeholders use the resource (Firey 1960). Therefore, changes within the social system can cause changes in patterns of resource use. Habermas (1975) describes the integration of culture, politics, and economics as subsystems inherent to the nature of social

systems. Because all subsystems interconnect, they all influence resource use (Habermas 1975). For instance, legislation that limits the areas in which pigs may be hunted can be created in the political system, and the popularity of pig hunting may decline, thus limiting the withdrawal of the resource from the environment.

There is inherent complexity within socio-ecological processes, due in part to multiple actors and values associated with the social system, but also to the complexity of ecosystems as a whole. Ecosystem complexity is a function of ecosystem processes and the interplay of the multiple agents and variables that effect change in these systems (Garmestani et al. 2009). Holling (1996) suggests that resilient ecosystems as characterized by variables that interact at multiple scales and fluctuate within realms of their own temporal and spatial features which in turn impact the functioning of the whole system. The challenge in managing these systems stems from determining how to address this complexity through the management process.

The socio-ecological system perspective is tied to the concept of ecological resilience, a concept that incorporates several components including: 1) the amount of disturbance a system can contain while still maintaining its integrity, 2) the extent to which the system is able to self-organize (e.g., the ability of a system to configure itself irrespective of the conditions at its inception), and 3) the extent to which the system is able to increase and renew its ability to adapt and learn (Bonabeau 1998; Carpenter et al. 2001; Crutchfield 1994; Garmestani et al. 2009; Gunderson and Holling 2002; Holling 1973). Inherent to the concept of a socio-ecological system is the concept that a functioning system is resilient and able to persist over some period of time in part, because of its ability to adapt and change in the face of unpredictability (Holling 1973). A disturbance to the system can cause the system to change from one state of equilibrium to another. Resilience acts as a buffering mechanism that keeps the system intact (Berkes and

Folke 2000). Change can arise from outside or inside the system. External change results from increases in resources or depletion of those resources (Firey 1960; Habermas 1975; Parson and Shils 1951). A sudden pig population boom can lead to an increase in available pig resources. Internal change is the result of changing conditions in the subsystems- e.g., if funding to control pig populations becomes unavailable, this could potentially cause an increase of this resource.

Equilibrium resilience is described as a kind of steady state of balance; a point of stability where resilience is recognized in the ability of the system to quickly return to equilibrium and resist disturbance (Holling and Meffe 1996). This kind of resilience has traditionally served as a focus for natural resource managers (Berkes and Folke 2000; Garmestani et al. 2009; Holling 1973). Equilibrium resilience focuses on a system's ability to resist disturbances versus ecological resistance, which, Berkes and Folke (2000) describe as focusing on the "magnitude or scale of disturbance that can be absorbed before the system changes in structure" (Holling 1973; Holling and Meffe 1996).

Managers that focus on ecological resilience tend to use adaptive management strategies. Meanwhile, equilibrium resilience typically underpins traditional management methods. These methods attempt to simplify the management of socio-ecological systems by reducing the scope of the system, deliberately reducing the way the system is structured or functions in an effort to increase the amount of stability or predictability of the system (Holling and Meffe 1996). This may initially produce the desired result, but is not sustainable because the process of attempting to maintain a static equilibrium ultimately causes the loss of ecological resilience—the ability of the system to adapt to disturbance—and can lead to at least a partial collapse of the system the management practice attempts to maintain.

Government policy for the management of feral pigs follows just such a strategy. Current pig management approaches usually simplify spatially by tying the pig resource to particular parcels of land and basing management policy on these ties. Acceptable pig-management strategies are dependent on the type of land allocations on which they reside.

Factors That Impact The Management Of Socio-Ecological Systems

The determination of how feral pigs are used as a resource is based on processes of community consideration, public choice, and agreement (McCay 1996). In order to appropriately manage a resource it is thus necessary to create management practices that consider local stakeholder values, concerns, and knowledge and occur in a realm that includes a functional communication network. In this way, management strategies can be created from a more complete knowledge base about the resource and resource users; this requires the partnership of biological, economic and socio-political aspects of management (McCay 1996; Ostrom 1998, 1999). One strategy for navigating the complexity of relationships surrounding the use of pigs is through the incorporation of public participation into management practices.

Public participation (PP) refers to the involvement of individuals who are not state officials or resource managers in the administrative decision-making processes (Beierle and Cayford 2002; International Association for Public Participation 1997). Public participation has in recent years been widely advocated as a key component to natural resource management (Eden 1996; United Nations 1997, 2009). It helps managers to better understand the manner in which resources are used. Public participation helps facilitate the management of resources by clarifying the system of resource users and the complexity of resource use. The use of public participation in natural resource management has several advantages over non-participatory management projects. For example, Beierle and Cayford (2002) undertook a comprehensive

study of 239 cases of public participation in environmental decision-making that covered a 30 year time span in the United States. This study and others, suggest the use of public participation can improve many features of the natural resource management process. Participation is found to provide better quality information for making decisions, accelerate conflict resolution processes, improve judgments in making management decisions, and improve the social climate in which management decisions are made (Beierle and Cayford 2002; Siemer and Decker 1990).

Despite the importance of participation to natural resource management, it is apparent that with only a few exceptions, feral pig management policy is created and controlled or jointly managed by federal, state, for-profit, and non-profit institutions. These institutions traditionally appear to receive little input from local stakeholders who are also concerned about the resource (e.g. recreation, commercial, and subsistence hunters; Bomford and Caughley 1996; O'Brien 1987). The lack of consideration by managers of stakeholder interests in feral pigs means that crucial information about resource use is lost.

An understanding of stakeholder beliefs and values regarding a resource provides essential knowledge about resource use. It is not sufficient to consider only this direct relationship, however, because stakeholders do not always act on their beliefs and values (Gardner and Stern 2002b; Goffman 1959; Russell and Harshbarger 2003). It is also necessary to evaluate the relationships among stakeholders, because the power inherent in these kinds of interactions influence the actions of stakeholders and in turn their use of the resource. Foucault (1980) suggests that power is not about discerning who holds it; it is the historical context of power that helps us to define it. He suggests that definitions of power are derived from our history. Historical processes- events, discourses, the use and abuse of knowledge- all serve to provide the cultural background and concepts that inform modern definition of power and its

uses. Conceptualizations of power are based on our own perceptions of ourselves and our beliefs about the kind of power we and others hold and our understanding of the meaning of power (Dreyfus et al. 1983; Forgas and Williams 2001; Foucault 1980). Power and knowledge are inexorably connected so that power may be derived from learning, but knowledge, the accepted truths of a society, may be generated by power. This provides the notion that there can be no one truth, only truth imbedded within the relative perimeter of a particular society. Similarly, perceptions of power are influenced by relative parameters. Power "is relational; it becomes apparent when it is exercised" (Foucault 1980; Townley 1993). So one way study power is to examine people's perceptions of power (Forgas and Williams 2001). Frame analysis is a method that can be used to evaluate multiple aspects of stakeholder relationships including stakeholder beliefs and values, power relations, and the role of participation in management practice.

Frame Analysis

Frame analysis is frequently applied to examine complex environmental management issues and has its foundations in discourse theory which is widely used to examine communication between stakeholders (Rydin 2003; Schon and Rein 1994). Discourse is about the creation of knowledge through language and practice. It defines the way a subject is evaluated and discussed (Foucault 1972; Hall 1997). There are multiple discourse strategies that can be applied to the analysis of common pool resource systems. The essential purpose of frame analysis is to describe the context for the discourse occurring between stakeholders. Frame analysis examines the attributes of the lenses through which stakeholders interpret and then perceive new events or scenarios with which they are confronted (Goffman 1974; Minsky 1975; Scheff 2005).

This study applies the cognitive paradigm based on the work of Dewulf et al. (2009) to examine feral pig management. The basis of the cognitive frame is rooted in the work of Minsky (1975), who described the foundation of frames as being in the memory, and that a frame behaves as a "remembered framework to be adapted to fit reality by changing details as necessary." People draw upon these frames when presented with a new event or scenario. A frame is defined as a "data structure for representing a . . .situation" (Minsky 1975). While a frame can be considered relatively constant over some period of time, frames can change as we change (Dewulf et al. 2009; Scheff 2005). Frames are affected by both internal and external influences, and are developed with both conscious and subconscious input (Benford and Snow 2000; Benford and Snow 2005; Dewulf et al. 2009; Johnston and Lio 1998; Johnston and Oliver 2005; Matthes 2009; Oliver and Johnston 2005; Scheff 2005). Stakeholders apply multiple frames to every scenario, which Minsky (1975) refers to as 'frame systems'. The beauty of frame analysis is that it can be used not only to examine intractable conflicts, but to determine arenas for reframing conflict in order to begin to develop management solutions. Reframing is the process of reinterpreting issues or reappraising other stakeholders or their values in the conflict. The purpose of reframing is to help facilitate the process of moving from conflict to collaboration. Reframing does not always guarantee the resolution of conflict, but it does offer at least the potential to facilitate or defuse some aspects (Lewicki et al. 2003; Schon and Rein 1994; Shriver and Peaden 2009).

In this study, I focus on stakeholder management strategies, their perspectives on current management practices, and stakeholder definitions of what elements are essential to successful pig management. I employ 'conflict management' frames to describe how stakeholders believe conflicts should be managed (Gray 2003; Hanke et al. 2002).

Research Setting

To understand how feral pigs can be managed in the Cassowary Coast Regional Council (CCRC), it is necessary to understand state land tenure regulations. Two main forms of land occupation are found within the study site, freehold land and non-freehold land, according to the Land Tenure Act of 1994 (Office of the Queensland Parliamentary Counsel 2012; State Land Asset Management 2010). Freehold land is privately owned, but the state government still has the ability to legislate and continues to hold some rights over the land, e.g. rights to minerals and petroleum. Non-freehold land is controlled by the State of Queensland, but may be used in a variety of ways through permits, licenses, or leases. It may also be reserved for use as roads, community purposes, or in other cases may not be the subject of tenure. The Native Title Act of 1993 impacts how these lands are relegated (Attorney General's Department 2012; Office of the Queensland Parliamentary Counsel 2012; Tribunal 2009). Native title allows traditional land owners to apply for exclusive ownership of certain lands such as vacant or crown lands and lands on which they already reside, and provides for non-exclusive rights over other types of lands which grant TOs the rights, for example, to live in an area, teach, hunt, fish, gather food or medicinal plants (Attorney General's Department 2012; Tribunal 2009). Farms and council lands in the CCRC are generally freehold properties, and national parks, reserves, and state forests are non-freehold properties (Office of the Queensland Parliamentary Counsel 2012; State Land Asset Management 2010).

Pig legislation and management in QLD. A review of Australian pig management legislation by Izac and O'Brien (1991) describes the lack of clarity and the large variation in pig management policies in this literature. Feral pigs were introduced to Australia as a food source

during European settlement in the early to mid-nineteenth century (Choquenot et al. 1996; Department of Sustainability 2011; McGaw and Mitchell 1998). Pig management has been a concern in QLD since 1930 when the first regulation was passed declaring feral pigs a pest and requiring their management in one district of QLD. Feral pig regulations were officially adopted state-wide in 1973 (Izac and O'Brien 1991). The original policies required pig control, but as pig populations grew, policy also evolved. Current pig regulations require stakeholders to not only control pigs on their properties, but to take 'reasonable' actions to keep their properties 'pest-free' (Office of the Queensland Parliamentary Counsel 2011). Federal policy also incorporates pig management legislation. The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) describes the "predation, habitat degradation, competition and disease transmission by feral pigs" as a "threatening process." In conjunction with states and territories, a deliberately vague management plan was created basically requiring 1) prevention of the spread of pigs to areas where they do not occur, 2) integration and implementation of pig management plans at all political levels, 3) quantification of pig damage, 4) awareness programs about pigs and damage, and 5) development of management tools to the most humane standards (Department of Sustainability 2011).

There have been numerous management schemes enacted in QLD over the years to control pigs. All these programs have ultimately broken down. For example, a bounty paid for pigs culled was first introduced in 1870 and received state government backing in 1945 (Choquenot et al. 1996). Growers, graziers, and hunters participated and the bounty served to provide extra income and help compensate the cost of pig management. It also served to encourage pig-control actions, provide some information about pig populations and movement, and appeared to have had some impact on pig populations (Laun 1971; Smith 1990; Tomlinson

1957). The bounty, however, was phased out in 1975 because of the failure of the system. The failure was in the form of fraud, for example pig scalps used as proof of culling were transferred from regions with lower bounties to those with higher bounties or pigs were deliberately bred and released for the sake of collecting bounties. There were also the suggestions that ultimately pig numbers might not be decreasing, and as pig bounties increased, they eventually were considered to exceed the value of pig damage (Choquenot et al. 1996; Hassall and Associates Pty Ltd. 1996; Laun 1971; Rolls 1969). This bounty program was followed by multiple contract trapping programs primarily through the Queensland Parks and Wildlife Service division.

Principle Pig Management Models CCRC

Aside from the management methods employed by individual stakeholder groups, the main management models used in CCRC area were the Community Based Feral Pig Trapping Program (CBFPTP) and the Terrain Integrated Feral Pig Management Model (TIFPM). Additionally, prior to the facilitation of the CBFPTP, the Sustainable Best Practice Feral Pig Management trial served as a precursor to the TIFPM and several chiller boxes (privately registered refrigerated boxes whose owners collect, and prepare pig meat for overseas shipment and sale) ran in the area and continued to run concurrently with the CBFTP program (Table 1). The CBFPTP occurred in the region before the current study took place. The Terrain model was employed at the time this present study was conducted

Table 1. CCRC principle pig management programs since 1993.

Name	Program Dates	Running Costs	Location	Actions
Community Based Feral Pig Trapping Program (CBFPTP)[1]	1993-2002	AUS$1,011,202 total	Daintree in the north through to Hinchinbrook Shire	Trapping
The Sustainable Best Practice Feral Pig Management Project[2]	1994-1996	AUS$153,278 total	Mission Beach/Tully area	Trapping
Terrain Integrated Feral Pig Management Model[3]	2007-2010	AUS$248,589 proposed annual funding	CCRC area	Trapping an poison baits
Chiller Boxes[4]	1980s-present	Pigs valued at 34kg at an average of AUS$50.00 and for large pigs at 177kg could be valued at approximately AUS$140.00.	Originally throughout Queensland now limited to a few larger towns and cities	Cold storage and sale of feral pigs caught through trapping

[1]Hillier (2002) [2] Noble (1996) [3] Noble(2007); Boar Busters (2009) [4] Takahashi and Tisdell (1989)

Community Based Feral Pig Trapping Program (CBFPTP)

The CBFPTP was devised in a joint effort by the then Department of Natural Resources and Mines (NR&M), Queensland Parks and Wildlife Service (QPWS), and the Wet Tropics Management Authority (WETMA), and included a number of agricultural and community conservation groups. It was funded mostly by NR&M and WETMA, but funding was provided by various other environmental management organizations and in-kind support was provided by management groups, trappers, and other agencies- e.g. vehicles, out of pocket expenses, small stipends for trappers. An estimated 14,221 pigs were destroyed with the average cost to remove one pig over the nine years estimated at AUS$71. There were five primary levels of management in the program. NR&M employed a project assistant who managed and administered the

program. A consultation group of stakeholders, the Feral Pig Advisory Committee acted as supervisors for the program—this group included environmental and agricultural managers, councils, and informal landowner groups. A series of several field coordinators were employed over the years to manage the project on-ground on a day-to-day basis.

Trappers (recreational hunters, farmers, and professional trappers) ran the trap lines (Hillier 2002; G. Shuster, unpublished data). Some of the contract trappers were also responsible for managing local chiller boxes. Hunters had no input into the program planning or management. TO input was attempted, but in most cases TOs were never successfully integrated into the program. This later was acknowledged as a point that needed revision for future pig management processes. The process was generally considered successful in trapping pigs and engaging the community, but was not financially sustainable. There were also additional concerns with the trapping of non-target species and the lack of impact assessments of trapping efforts on the local ecology. There were concerns about the way the program was managed by the various officers who were employed to occupy the position of field coordinator over the years and a sense of lack of ownership over the project by some stakeholders. Access issues were also considered a concern, because trappers were not allowed access into protected areas, e.g., national parks and state forests (Hillier 2002; G. Shuster, unpublished data).

The Sustainable Best Practice Feral Pig Management Trial

This project was a predecessor to the TIFPM. The purpose of the Sustainable Best Practice Feral Pig Management project was to develop best practice techniques for including community in pig management and to demonstrate that this was a feasible possibility through a trapping trial. The project was conducted over a two year period. It was initiated by the

Department of Natural Resources (DNR) with the cooperation of various environmental management organizations.

The project incorporated community conservation in the format of a supervisory board of those providing funding for the project, which, consisted of a panel of environmental and agricultural managers. In addition to the supervisory board, a part-time manager was employed by the DNR and a full-time project officer was employed. DNR provided in-kind contributes of AUS$65,400. Additionally, 100 agricultural landholders were surveyed and the project intended the involvement of 75% of these farmers. Instead, only nine of these had any real involvement in the project. This project occurred concurrently with CBFPTP. The trapping method was found to be successful in capturing pigs with minimal impact on the environment, but community integration into the program was never successfully achieved. This was attributed to methodological failure, but also lack of sociological training and a failure to adequately recognize the importance of the human dimension to pig management (Noble 1997).

Terrain Integrated Feral Pig Management Model

The Terrain managed Integrated Feral Pig Management Model (TIFPM) was a follow-up to the CBFPTP (Noble 1997). It attempted to create a program that adopted successful strategies from the CBFPTP while improving on some of its shortcomings. Terrain aimed to design a program with sustained funding sources, reduced pressure on landowners to facilitate much of the trapping, and with a sustained and proactive management strategy. All stakeholders participating in the program were financial investors in the project, and they participated in the management committee. The stakeholders included environmental and agricultural managers. Representatives from each of these groups attended committee meetings and participated in the management decision-making.

There was one project coordinator from Terrain who oversaw the entire project and organized committee meetings and an on-ground service provider. The contractor facilitated the on-ground pig control activities and participated in the development of the program. Newspaper articles and a best practice guide were used as forms of communication with the public. The program also had a public contact number and conducted some trapping in response to this communication. During the first year of the project, the program responded to these calls by trapping in three locations around CCRC that were not already programed into the trapping regime (Noble 1997).

Chiller Boxes

Even before the initiation of chiller boxes, during the 1970s, feral pig meat was sold to abattoirs for processing and local consumption or poor quality meat could be converted to make meat and bone meal for fertilizers. In 1979, a change in government policy made the export of field shot game meats legal. There was an export market for feral pig meat for the purpose of consumption in countries such as Japan, Germany, and France and the meat could also be sold for pet food. In 1984, approximately 2 million kg of pig meat were exported with an export value of about AUS$ 10 million (Takahashi and Tisdell 1989).

The amended legislation allowing the export of game meats also require particular care of these meats prior to and during processing, so the meats had to be carefully chilled and inspected. This provided for the advent of chiller boxes that pay hunters for meat provided directly to the boxes in which meat can be chilled and the initial preparations for consumption could be made. A study by Ramsay (1994) found an estimated 70 chiller boxes existed in Queensland in 1996 and these boxes received about 65,000 carcasses, representing approximately 60% of the national total. The meat was valued at between AUS$6 and 12 million

worth of feral pigs per year (McGaw and Mitchell 1998; Ramsay 1994). In recent years, several of the chiller boxes in far north Queensland have shut their doors (G. Shuster, unpublished data).

Methods

This study represents part of a larger action research study that began in 2007 (Chapter 1). Researchers and other relevant stakeholders worked together to develop research questions, design and carry out a study, and disseminate information. This form of research requires constant evaluation, feedback, and cycles of reflection to help assure that the principles of action research are maintained and produces a practical action as a result (Greenwood and Levin 1998; Herr and Anderson 2005; Portelli 1998; Russell and Harshbarger 2003). The study was designed in conjunction with hunters, growers and had some input from traditional land owners (TOs). The study goals, data collection methods, interview guides, and participants were selected with the assistance of hunters and farmers. Traditional owners assisted with participant selection, but were incorporated into the study later so three of the five TOs were incorporated into the study early enough to have some input into the data collection methods. All TOs were asked for feedback about the study goals, data collection methods, and interview guides regardless of when they joined the study. Data were collected using oral history and individual interviews, participant observation, and sociograms. Data analysis was based on a grounded theory approach and themes derived from the grounded theory processes were further evaluated using a cognitive paradigm of frame analysis.

The study was conducted in the Cassowary Coast Regional Council (CCRC) area in the Wet Tropics of Northern Queensland between 2007-2009. The CCRC area covers 4,700 km^2. The limits of this region include the town of Garradunga to the north, Cardwell to the south, East

Palmerston to the west, and the most eastern boundary is not marked by a particular town, but by a complex of islands and reefs that make up part of the Great Barrier Reef Marine Park. The region consists of approximately 31,291 people. The official language is English, but there are a number of indigenous dialects spoken, and because there is a significant migrant history, 48 languages are used in the region (CCRC 2011; Girringun Aboriginal Corporation 2012; Henzell 2007; Simmons 1993).The average annual rainfall for the region is 3,056 mm with average daily temperatures ranging between 18.5 C and 27.2 C. The wet tropics region includes the largest contiguous rainforest found in Australia and includes 13 types of recognized rainforest structures, small areas of wet sclerophyll and eucalyptus woodlands, and swamps. The area includes forest mountains and high plateaus as well as coastal lowland forests and swamps (CCRC 2011; Ramsay and Cairns 2004).

A total of 52 collaborators were interviewed for this study (Table 2). Oral histories were conducted with the principle collaborators, the 15 hunters and 15 farmers. In addition, I observed that TOs, a key group, were missing. Thus, oral histories were also conducted with individual representatives of each of four mainland TO groups of the CCRC area: Djiru, Girramay, Jirrbal, and Ma: Mu. The final TO interviewee was unable to identify his ancestry.

Individual interviews were conducted with the remaining 17 participants. The two principle collaborator groups referred these participants to me. This last category of participants, referred to simply as ‘managers,’ included several types of environmental and agricultural managers, government, and commercial representatives (Table 2). Environmental managers work for organizations concerned with the management of public lands and are public or non-profit organizations. I also included a CCRC council representative (CCRC Rep), because this stakeholder is a land manager responsible for on-ground management of council lands.

Agricultural managers are part of both for-profit and non-profit organizations with interests in the agricultural sector. There is additionally one state government representative, one other CCRC representative and the commercial representative is a local contractor.

Table 2. Description of the collaborators who participated in the interview process. This table includes information about the interview types used, collaborator identity, type and the number of participants in the study.

Interview Type	Identity	Type	Number of Participants
Oral History	**Farmer**	Cane	5
		Banana	5
		Tropical Fruit	3
		Grazier	1
		Plantation	1
		Total	15
	Hunter	Bow Hunter	5
		Pig Dogger	5
		Rifle Hunter	3
		Prof Trapper	1
		Prof Chiller Box Hunter	1
		Total	15
	Traditional Owners	Djiru	1
		Girramay	1
		Jirrbal	1
		Ma:Mu	1
		Other	1
		Total	5
Individual Interviews	**Managers-Environmental**	Wet Tropics Management Authority	1
		Department of Primary Industries and Fisheries	1
		Terrain Natural Resource Management	2
		Queensland Parks and Wildlife Service	4
		Communities for Cassowary and Coastal Conservation	2
		CCRC Council Representative	1
	Agricultural	Tully Cane Productivity Services, Ltd	1
		Canegrowers Australia	1
		Tully Sugar Mill (Tully Sugar, Ltd)	1
		Total	14
		State Government Representative and CCRC Council Representative 2	2
	Commercial	Boar Busters	1
		Total	3

Data collected in the form of participant observation included informal feedback from multiple other CCRC residents. The Tully Bow Hunters Club, the Kurrimine Bow Hunters Club, and the Queensland branch of the Sporting Shooters' Association of Australia assisted with this study. Staff from the Commonwealth Scientific and Industrial Research Organisation and Terrain Natural Resource Management, who sponsored the study, and Boar Busters also participated. The survey was conducted with a group of 30 experts. While many stakeholders who participated in the study design requested the use of a survey as a data collection method, they had minimal involvement in the participant selection and did not assist in question design for this portion of the study.

Data Collection

Planning And Group Meetings

Planning meetings were held separately with farmers and hunters at the beginning of the study to organize the research process. Planning meetings were later held with TOs. Group meetings were held with these stakeholders throughout the research process in order to reflect upon and revise the research process.

Oral History

Participants suggested that I use oral histories as the principle interview method. Oral histories are a type of individual interview that provides one person’s viewpoint of events (Portelli 1998b). The interviewee is the main speaker who leads the description of events, people, places, and stories. The interviewee in an oral history is sometimes referred to as a narrator for this reason. The role of the interviewer is to help guide the interview. The interviewer helps to keep the interview from straying off the topic. He or she helps ask questions

to probe, explore, and clarify the depths of the story being unraveled (Sommer and Quinlan 2002).

The type of oral histories recorded here are single-issue interviews. These histories provide detailed information and insight into one particular subject (Douglas et al. 1988). I used single issue interviews to review a participant's history in relation to pigs. This method was used to interview all hunter, farmers, and TO participants. I held one or two sessions with each participant over a maximum of approximately two hours. Collaborating hunters, farmers, TOs, and I created an interview guide to direct these interviews. The purpose of the guide was to act as a flexible plan for the interview; it included important topics, but specific questions and the exact phrasing varied depending on the direction taken by the narrator (Yow 1994). Answers to these questions might be provided by the narrator without prompting while he presented his narrative about pig management.

Individual Interviews

I also conducted individual interviews with hunters, farmers, and TOs considered important to feral pig management. Interviews were presented in a semi-structured format (Bernard 2000, 2006; Booth et al. 1995; Morgan 1997). These interviews, unlike oral histories, were interviewer led and addressed specific topics included in the format, although some flexibility remained in the direction and ways these topics were addressed (Bernard 2000, 2006).

Participant Observation

I used this method to examine day-to-day activities considered important to understanding a research question. The researcher participates in some event or looks at a place to experience what it is like and why it is important (Bernard 2000). In this case, study participants requested that I observe and experience firsthand incidences of pig activity and

damage, hunting, and any other events that participants considered relevant. I resided in the CCRC area for the duration of the study. I participated in site visits to examine pig damage on farming properties and in protected areas. I participated in hunting trips, joined the Tully Bow Hunters Club, and attended the Kurrimine Bow Hunters Club. I participated in community events and attended pig related activities that were open to the public such as pig weighing competitions. I also studied photographs of pig damage, hunting, and video footage of pig hunts. In addition, I examined the local paper, the *Tully Times*, and pig hunting magazines.

Participatory Sociograms

Sociograms are visual representations of stakeholder relationships. They depict with whom stakeholders have relationships and provide information on the kinds of relationships (e.g., positive or negative) they represent. Sociograms include relevant nodes and ties (Katz et al. 2004) . Nodes are points that represent each stakeholder while ties are lines that describe the relationships. For example, a one way line with an arrow may describe a relationship in which one stakeholder provides information to another (Katz et al. 2004; Wasserman and Faust 2007). The sociograms used in this study represent 'ego-centric' networks. They describe only the direct relationships between the focus stakeholder and other stakeholders (Bourne and Walker 2005; Hanneman and Riddle 2005; Katz et al. 2004; McCarty et al. 2007; Wasserman and Faust 2007). Sociograms used in this study depict the social landscape as perceived by stakeholders. These 'social maps' represented the landscape of the feral pig resource system through diagrams created by participants that described the socio-political relationships between hunters, farmers, and other stakeholders.

I conducted individual sociogram-making sessions with all the participants I interviewed. During a sociogram session, participants were given the option of creating sociograms with

markers, pencil, or pen on paper. The purpose of making the maps was to investigate how stakeholders perceived they were connected to other participants associated with feral pig management. A participant depicted himself by placing an oval with his name at the map's center. Other stakeholder ovals circle this center oval as indicated by the participant's placement of them. The types of ties between participants used here were adapted from Wasserman and Faust (2007) and provided information about the charge of the relationship (positive or negative), the directionality of the relationship (which individual shares information with whom), relationship type—whether relationships were mutual (information or resource sharing) or unidirectional (e.g., one person provides information to another without reciprocation).

Survey

A survey was designed in collaboration with Dr. James Butler from the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Tropical Landscapes Program, Bill Dorney of the Department of Primary Industries and Fisheries, and Bart Dryden of Terrain Natural Resources Management. The survey participants were considered to be leaders in pig management action and their views of two different types of management models employed in the Wet Tropics of FNQ were examined. These participants were considered experts. Experts for this survey were defined as people who participated in or had significant knowledge about one or both feral pig management models. The 30 experts that participated in the survey were asked to review two feral pig co-management models used in the Wet Tropics and to identify their strengths and weaknesses.

In selecting the panel of experts, we attempted to represent all stakeholder types that are involved or interested in pig management in the Wet Tropics. The participants were government officials responsible for pig management; members of NGOs with a stake in pig management;

various types of pig hunters, both recreational and professional (gun, pig doggers, bow hunters, and trappers); growers and grower organizations- cane, tropical fruit, and banana; and TOs who participated in the model. This provided for a diversity of views regarding pig management strategies. The experts were asked to respond to survey questions about the feral pig co-management model with which they were familiar. The survey used a Likert scale to indicate the importance of each item to the pig management models. The survey questions were based on six principles for successful co-management developed by Plummer and Armitage (2007). These principles state that in order for resources to be successfully co-managed, the management model must include:

- Principle 1. An adaptive framework robust enough to overcome challenges
- Principle 2. Evaluation/reflection based on monitoring of management actions and subsequent modifications
- Principle 3. Sustainable outcomes (e.g., successful pig control)
- Principle 4. A process in which stakeholders and government develop, implement, learn, and make adjustments in pursuit of a more resilient system
- Principle 5. Empowering of the actors involved
- Principle 6. Inclusion and effective participation of all actors in the process.

Two additional principles were added based on the experiences that James Butler, Bill Dorney and I had with the pig models. These principles state that successful management models must have: 1) sustainable resources (i.e. funding), and 2) the scale of model must be adequate to the ecological scale of the problem. The questionnaire was administered by phone. Participants were asked to reply to questions about each model with which they were familiar. The data were

analyzed using descriptive statistics to describe the median and the range of variability for responses (Harvey 1998).

Data Analysis

I indexed all the data collected, including oral histories, interviews, participant observation, sociograms, and notes derived from all research activities using mnemonic codes. The code names were derived directly from concepts in the study (e.g., SOC for social, PIG for feral pig; Bernard 2006; Miles and Huberman 1994). These codes were used with date, note number (consecutive identification of notes and interviews), and delimiter codes (these codes help a computer to identify the beginning and end of each item) to quickly identify and locate notes, interviews, etc. about specific topics (Miles and Huberman 1994). I used the qualitative data analysis computer software package NVivo to analyze the collected data (Miles and Huberman 1994).

I analyzed the data using qualitative methods. I used grounded theory to categorize and derive concepts from texts and to link these concepts into substantive and formal theories (Strauss and Corwin 1990). Codes and major themes describing the perspectives of hunters and farmers regarding feral pig management were derived directly from analysis of transcripts and photos; codes were inductive, meaning that they were not conceived prior to data analysis. I used a process of triangulation to compare the results found in the interviews, discussion groups, sociograms, and participant observation. The codes and major themes that evolved from the grounded theory process were used to create a basic theory about the results. Aspects of this theory were described using frame analysis (Mills et al. 2007; Rydin 2003).

I examined the data resulting from the sociograms using a matrix to compare stakeholders (row labels) with the kind of relationships (column labels) they held with other

stakeholders. The relationship columns used a three point description—positive/strong relationship, intermediate relationship, negative/weak, or no relationship. A strong relationship was one in which stakeholders shared the most ties and a weak relationship was one in which stakeholders shared the fewest ties. A positive relationship occurred when stakeholders were happy with their connection with others and shared satisfying exchanges. An intermediate relationship was one in which there was a mix of positive and negative exchanges or in which a relationship was simply equitable. A negative exchange occurred when stakeholders felt a deep dissatisfaction in their communicative interactions with others. No relationship describes the case in which there was no exchange between stakeholders. Stakeholders were aware that these other participants were involved or should be involved in pig management in some way, but they shared no personal ties to them.

I based the matrix data analysis on the results of the maps and on participants' responses to questions about these maps as well as their descriptions of stakeholders in interviews. For example, a stakeholder might describe 'no relationship' as being negative, because no relationship existed where there should be one. An 'intermediate relationship' could be intermediate for a number of reasons. For example, it could be intermediate because a stakeholder shared positive information with another stakeholder and received negative feedback. It could be intermediate because these two groups shared some regular exchange that, like any relationship, contained positive and negative moments. It could be intermediate because there was some regular exchange, but this exchange was not charged—for example, a hunter might pay x dollars to a shop owner to buy hunting equipment and receive the equipment with payment.

Results

Stakeholders

Stakeholders were categorized into two principal social structures according to the parameters described below. They were the Farmer/Hunter/TO and Manager social structures and were described in detail in Chapter 3.

Farmer/Hunter/TO Social Structure

This social structure, which includes farmers, hunters, and TOs (called FHT) revolves primarily around informal norms. In this arena, knowledge systems about pigs are based on personal experience, cultural/historical interactions, and science plays a lesser role. Power is derived primarily from either resources (the ability to act based on ownership of key items for management) or personal power (associated with social capital; Gray 2003). These stakeholders have a strong 'sense of place'-of being tied in some way to the local area.

Manager Social Structure

The institutions of the manager social structure focus primarily on formal norms. The manager knowledge system is based on scientific knowledge and experience. Power is associated with available resources, authoritative (power imbued to a position by the government), and expertise power (Gray 2003; Lewicki et al. 2003). These groups also tend to have a shared communication system that differs somewhat to that used by the FHT structure. No shared sense of place exists amongst managers, but most have a sense of being separate from the local community.

Current Management Strategies

The management strategies presented here were described to me by the managers I interviewed. They are the strategies employed on the ground in contrast to what might be officially documented in management plans. Pigs are considered the most important feral animal pest, but they are not the top priority in land management. There are many concerns such as weeds, emerging pests, crop disease control, and fire control that take precedence. The management focus is on the lands designated to a particular organization with some consideration of neighboring properties. According to managers, pigs will never be eradicated, and pig management is particularly important for public relations management.

When describing important considerations for pig control, managers appear to be most concerned with the cost-to-benefit ratios involved in management. They focus on the question, 'how much will it cost to control pigs in comparison to how much damage we currently see them doing?' Managers generally feel that there is a low cost-benefit ratio associated with pig control; the cost of management outweighs the amount of damage found. Damage is generally measured based on the amount of pig damage managers observe when they conduct forays onto public lands. These forays are not specific to monitoring pig activities, but rather observations made while carrying out other works on public lands. The observations are made along well used trails used by management staff and/or visitors to public lands. Managers report that on most occasions minimal damage is perceived. Less important, but still sometimes a consideration in management decisions, is the desire for good public relations with the community. As mentioned, managers, like all stakeholders, feel pigs cannot be eradicated. Several managers quoted to me a statistic from Hone and Robards (1980) stating that it is necessary to eliminate 70% of a pig population in order to have a long-term impact. This management goal is generally

considered an impossibility due to various factors, particularly pig behavior, and the challenges posed in working in rainforest habitats. Most managers, therefore follow alternative management goals.

The principal goals variously employed by managers are to 1) try to eliminate strategic problem pockets of pig populations—e.g., pigs on islands can sometimes be easily eliminated due to their limited range within island boarders, 2) provide pig control when signs of 'significant' pig damage are found, 3) target specific locations or habitat types where pigs cause significant damage to particular species or ecosystems, e.g. pig "hot spots", and 4) enact management protocols in direct response to community complaints about pigs, or areas where pig damage is highly visible to visitors, e.g., national park walking tracks. Occasionally, depending on the presence of a favorable political climate, state and federal government managers, in response to community concerns, set aside specific funds to be applied to instating new pig controls over a short-term period of time.

The specific strategies described by managers for addressing the public in regards to pig management incorporate a range of practices from no engagement to greater engagement levels. These strategies were: 1) no communication with public—this kind of communication is not part of the responsibility of pig management, 2) increased community awareness about pigs through the use of pamphlets and other such material made available to the public, the use of organizational media units to offer the public media information (e.g., to announce important management activities that will be, or have already been, initiated) through such mediums as newspaper articles and extension workshops, 3) investing in the Terrain Integrated Feral Pig Management Model (TIFPM) one of whose roles is to take responsibility for engagement with the public via phone contact and through a committee, 4) receiving communication from

community members via phone or in person about pig complaints and supplying these stakeholders with traps to use on their properties as needed, 5) attend committee meetings that include agricultural industry stakeholders, and 6) community participation on a committee in which landowners- e.g., farmers and agricultural industry groups who provide funds for project management- also provide feedback on pig management. The 'community stakeholders' described here generally consisted of farmers and local landowners and usually did not include hunters or TOs. Government representatives tend to view pig damage as an area of high concern in part, because it is important to their farmer constituents.

There are several different management strategies employed by FHT members. Farmers consider pigs a significant pest species and the management of this species as urgent, particularly cane and banana farmers who can suffer regular pig damage. These farmers are most concerned with the economic costs accrued by pig damage. They are also concerned with the consequences of long-term crop and ecological damage. Farmers feel that, unchecked, pig populations and the associated pig damage will increase over time. The potential threat and spread of disease from pigs to domestic livestock is also a pressing concern. For farmers, pigs are an important management concern, but so are other farm maintenance issues such as weed control and rat control. It is for this reason that regular farming practice tends to incorporate the most time efficient management methods to control pigs, even if they are not the most economical. The most costly of these strategies is the employment of electric fencing. Many farmers also employ or allow people to trap or hunt on their properties.

The farmer ideal would be the complete eradication of pigs. Farmers believe that pig populations, however, are so pervasive that it will never be possible to eradicate them, only to manage them. There is no one management process that is considered satisfactorily effective, so

farmers tend to use a mix of methods to address pig management, and management styles vary between farmers. Management actions are either a response to observations of intense pig activity, or else as a preventative to protect particularly susceptible crops. Management actions can also be opportunistic; if a hunter arrives and requests permission to hunt on a property, farmers may take advantage of the opportunity. Hunters can also help monitor pig numbers on a property through their regular visits. Additional hunting activities, can, of themselves serve to frighten pigs and chase them off properties. Farmers may also choose to fund contractors to hunt pigs on their land. Neighboring farmers might pool together to fund a contracted hunter, or individual property owners or else farming organizations may contribute to a pig program organized by someone from outside the community.

The goal of recreational hunters is not to control pig populations, but to enjoy the sport of pig hunting and to socialize with other hunters. They do recognize that pigs cause damage to farms and ecological systems in general. They don't believe that pigs will disappear, because they believe it is not possible to eradicate pigs. The hunters participating in the study, therefore, have no problem with the existence of pig control programs. Hunters' main concern with pig control programs is the encroachment of these programs on recreational hunter activities. Also, many would like to be included in pig management planning.

The more committed hunters may hunt locally several times a week, and some hunt daily. Some plan hunting trips that may occur over a long weekend or over several weeks at favored hunting sites outside the CCRC area. Recreational hunters are not paid for what they do however, farmers may occasionally provide some small token sum of money to show their appreciation. These might be enough to buy gas or extra bullets. Generally, it is the hunters that pay significant amounts of money each year for their hunting equipment and gas for travel.

Recreational hunters are often asked to deal with problem sites on particular properties. Some hunters work professionally for trapping programs and do get paid. There are also hunters who hunt illegally on public lands. Many hunters feel that they should have access to public lands in a manner similar to that given to hunters in Victoria where members of sporting shooters' clubs are allowed into state forest under a closely regulated program to hunt pigs.

Four of the five TOs who participated in this study perceive the damage caused by pigs on sacred sites and to ecological systems to be a threat to the environment. All five described a desire to participate in pig management planning and actions. They already enact some control through hunting practices. One TO submitted an application with a local management organization in the hopes of having his business contracted for pest management services including pig control. TOs are happy for management to use such methods as trapping and professional rifle shooting, but four of the five were particularly against the involvement of dogs.

Amongst the FHT members, farmers and hunters have a strong tie and work together in regards to pig management. Farmers generally do not engage with TOs specifically in regard to pig management. Hunters occasionally engage with TOs in regard to pig management; hunters sometimes share pig meat they have collected, and hunters who are not TOs may ask permission to hunt on TO lands. Hunters describe having either no interaction or negative interactions with managers in regards to pig management. TOs describe little to no interaction with managers, and farmers also describe having little to no interaction with managers. In so far as the level of interest of hunters and farmers in participating in the current study, they demonstrated great interest in participating in planning and feedback sessions, interviews, and tours of damage, and in providing examples of hunting practice, but little interest in collecting and analyzing the data themselves.

Landscape Use And Management

The use and valuation of the landscape in which feral pigs occur is also an important consideration to management. Landscape considerations include those of pig movements on the land, land tenure, and access to the resource. Management tools were variously employed throughout the landscape with habitat type impacting the kinds of management activities employed in a particular environment. Land tenure describes the official jurisdiction for management, and access determines where and how the resource can be approached.

Pig Movements

Farmers and hunters both feel that national parks hold source populations of pigs and that pigs move onto farming properties when looking for additional food sources. Thus, farms are depicted as a kind of sink area—it is not an ideal area to live because crops are cut, sources of water may not always be consistent, and pig populations are regularly culled. National parks offer shelter, food, and water, and according to farmers there is little threat of pig control due to the density of the forest. Managers do not tend to perceive pigs in this way; rather pigs are presented as being an equal problem throughout the landscape, preferring certain habitat types under particular habitat or climate conditions. TOs describe pigs as a strange animal that entered their landscape. One TO said that he felt pigs became more prolific with the clearing of land for small farms; it gave pigs the opportunity for easy access across the landscape and additional food sources. TOs also said that they see signs of pigs and damage both on farms and in the forest.

Land Tenure

Managers are the only stakeholders who consistently adhere to land tenure legislation when managing pigs. Pig control activities are conducted within the boundaries of the designated areas in which managers work, although some managers provide assistance, usually in the form

of traps and sometimes through the administration of poison bait, to neighboring farms. Some managers describe the desire to have coordinated control efforts among different parcels or regions of public or council lands, but this does not generally occur. The CBFPTP and the pig management program organized by Terrain provided the most concerted efforts with trapping occurring on farm properties throughout the FNQ region.

Farmers and TOs legally manage pigs on their properties. Many farmers act alone, but some farmers work jointly to control pigs; neighbors sometimes pool resources or activities or else share tools for pig control. For example, neighbors sometimes pool funds for aerial shooting programs on bordering properties. Other farmers, who do not feel they have pig problems may refrain from participating in pig control altogether. Some banana farmers actually encourage pigs on their properties so that they will clean up the property by consuming old plants and bananas that have fallen to the ground. FHT members often commented that pigs are unaware of political boundaries. They move wherever they prefer and may move often. These stakeholders attempt to address this mobility to some extent through their management practice. Many farmers enter at least the edges of neighboring national park or Council land in order to manage pigs. Hunters hunt primarily on farming properties, but may also cross into national parks or council lands to hunt pigs. Additionally, hunting dogs are equally unaware of political boundaries and may cross these boundaries, for example, during the pursuit of a pig. This, however, does not always occur, due to the special training received by some dogs. Hunters will follow the dogs to collect them and/or to complete the pig hunt. Similarly, TOs who hunt may cross boundaries to chase pigs.

Access

Property owners have the legal right to determine who enters the boundaries of their land. Legislation determines who has the rights to enter public and council lands. These represent

formal norms or regulations for access. Informal norms, however, may dictate who actually accesses the lands within CCRC and how it is done. When controlling pigs on their properties, farmers must consider the multiple activities that are occurring on their land. Trapping and poison baiting can be permissible any time of day, but farmers may prefer these activities to occur away from workers on the property in order to prevent injury. Hunting that involves the use of guns, bows, or dogs generally occurs outside cultivating hours, except on occasion when pigs are observed while out working in the paddocks, or if a special date is set aside for management actions –such as in the case of helicopter shooting. The different types of hunting occurring on the property may also need to be managed. Farmers like to know how many hunters will be on the property at a time and the type of hunters. This way they can let other hunters know who will be on the property, and limit the number or type of hunters who work on the property at a time. Regardless of the type of restriction, farmers generally only allow hunters they consider to be trustworthy and respectful of the farmer and the property.

Access to land for hunting is one of the most important features of being a hunter. Due to the structure of land tenure in Queensland, potential hunting properties of any reasonable size generally belong to or are controlled by farmers or TOs. Therefore, for easy access, it is desirable to have and maintain a good relationship with these stakeholder groups, particularly with the farmers. Farmers own a significant portion of the private land in the CCRC and access to these lands, with permission, is legal. Most hunters who hunt in the CCRC hunt on farmer owned lands. Access to prime hunting spots with large numbers of pigs and acceptable habitat in which to maneuver are competitive. Hunters with strong social capital might be asked by a farmer to hunt on his property to remove pigs. The more properties a hunter uses, and the stronger the

relationships with farmers, the more properties he is likely to be able to access. This can help hunters collect a property pool—a group of farms which they know they can consistently access.

TOs did not speak in detail about access, but did point out general guidelines. TO hunters that belong to a particular area of land are always allowed and encouraged to practice their hunting skills. These practices are considered subsistence hunting- the pigs are hunted for consumptive purposes-which is in keeping with traditional hunting activities. Though four of the five TOs interviewed did not approve of recreational hunting, and said that recreational hunting is not generally allowed on their lands, one of these TOs said that sometimes if a hunter offered him meat he might allow them to hunt. The final participant had friends in the CCRC community who were hunters and approved of his friends' hunting. Managers deny access for legal reasons. It is illegal to hunt in public and council lands. Managers are particularly concerned with possible injury to visitors or staff from hunting activities, the injury or death of wildlife as a result of hunting, and interference with management actions already occurring on these lands.

Management Tool Use

The current tools for feral pig control are somewhat limited. They include various types of traps, poison baits, guns, aerial shooting, bows, dogs, and electric fences. All stakeholders draw from this resource pool whether it is to enjoy the act of hunting or for deliberate pig control. These tools are used in a number of different ways. All stakeholders agree that traps are a useful tool for pig management, but not all stakeholders approve of other forms of pig control.

The broadest management practices are displayed by farmers. Most use some combination of all the management tools described here including the use of new and innovative capture methods. Many of their management efforts are reactive- methods such as trapping and recruiting hunters to collect pigs are often used in response to a particular damage event.

However, farmers also use proactive measures- the testing of new trap methods in order to organize a regular trapping regime is one example. Leaving paddocks near forest areas fallow as a buffer zone for pigs is also proactive, so is the regular use of electric fences to deter pigs from properties. The presence of hunters on farm property, although their visits may not always be regular, still serves as a kind of monitoring system for pigs on the farms. Hunters get a rough idea of how many pigs are on a property and which properties have the most pigs. They can also provide feedback to farmers about areas of high pig damage. Pig control is important to farmers, so those with pig problems generally conduct continuous management activities. Farmer management activities occur on the farm and in bordering areas including in the periphery of the rainforest itself through the use of traps and hunters.

Manager and TO strategies are much more restrictive. There is generally no regular pig-specific monitoring. Traps and poison baits are most commonly employed by managers due to the legal implications of gun and dog use, but guns are sometimes employed to remove pigs. Their strategies are a mix of proactive and reactive. A large part of trapping and some shooting occurs in response to observed pigs or pig damage, but some managers also employ trapping and aerial shooting regimes. Trapping is generally conducted along walking tracks and fire trails due to ease of access; very little management occurs off these tracks, except during the limited occasions when aerial shooting is possible. Pig control is not always considered worthwhile economically or ecologically and is not so important to managers in relation to other management activities, so control activities can be sporadic. TO practices are a little less restrictive- most of the participants describe the use of traps on their land and they also hunt on these lands and sometimes allow others to hunt there. The TOs generally did not approve of the use of poison baits. TO hunting forays are based on a desire for food supplementation and not

deliberate pig control practices, so these outings may not be regular. TOs generally hunted on TO lands, but some also had occasion to hunt on farms. TOs did not specifically mention hunting on public lands. Traps are usually managed by stakeholders from outside TO lands with the permission of TOs, so this may occur only sporadically.

Hunter practices are somewhere between the two groups; hunters generally employ all the tools described above except for poison baits and fences. Hunters love to hunt so for many of them, hunting is a frequent activity and not for pig control. Hunters hunt mostly on farms due to the ease of maneuvering on these lands, but may also hunt on public lands with a few hunters venturing off track within the rainforest itself. Together, these stakeholders- farmers, hunters, TOs, and managers- display an overlapping tapestry of management tool use. All stakeholders feel that the available tools are not quite adequate for the management of pigs and that the habitat is a difficult environment in which to work. All the stakeholders are generally on the search for better management tools.

Management Planning

Learning From Past Management Models

Many participants had experience with at least one type of pig control program—contract or community based. A total of 43 participants described their experiences with the Community Based Feral Pig Trapping Program (CBFPTP), the Terrain Integrated Feral Pig Management Model (TIFPM), experiences with a local chiller box, and/or other small scale regional programs through surveys, interviews, and sociograms. There were stakeholders who had never heard of one or the other program and many stakeholders had the misconception that the contractor management model was run by Boar Busters when it was actually run by Terrain. For both programs, people expressed concern that the programs could not be sustainable,

because if pig populations become adequately controlled, no one will want to continue to trap or contribute funds to the project. There is always the general comment that more controls should be implemented on public lands, particularly national parks. Both the CBFPTP and the Terrain program were trapping principally on private lands.

There were mixed reviews of the CBFPTP by all participants. Stakeholders appreciated the sense of community participation in the project and how this model took advantage of some of the available community resources for pig control. There was however, a sense that too much of the onus for running traps was put onto farmers, who lack sufficient time for regular control interventions. There was some confusion about how the program functioned. There was a sense that trappers were not always sufficiently compensated for their work. Some stakeholders felt there were flaws in the trap designs and time management for trap lines. Stakeholders felt that the program lacked sufficient coordination and that some of the coordinators were not suited to their positions, leading to conflict within the program. The funding was not considered sustainable and the latter two faults were believed to have led to the downfall of the program. The issue of liability insurance was a concern to managers, because of the presence of so many landowners and recreational hunters out running traps for the program. The only TO that was able to comment said that his group was given a trap to put on their lands, but no funding was provided for bait for the traps or a vehicle for regular access to the trap and removing pig carcasses. The TO said the program had not asked his community for their opinion of the trapping program, and he said there was little interest within his community for that particular project. Some recreational hunters who participated as trappers in the program were happy with the work they did, but were unhappy with the way the program ended- they complained that many trappers were never paid for their work.

The contract trapping programs run in the region also received mixed reviews. Some thought the program was excellent while others did not approve of the program. The reasons for these views were shared by most participants. Many participants, for example, appreciated that TIFPM was easy to coordinate, because it was managed by just one contract trapper. For this reason, deployment of on-ground controls was consistent. The presence of a contract trapper relieved the pressure on individual landowners participating in the program. There was a desire for more clarity in regards to the number of pigs captured and the details of the capture process. Many found the cost of the program prohibitive in comparison to the CBFPTP, which was conducted for a fraction of the cost and ran many more traps. They did not feel that funding the TIFPM program at the current level would be sustainable. Those opposed to the program and some of those who considered the program beneficial, described the need for better funding dispersal. Most stakeholders believed all the program funding was used to cover the contractor's running costs. Farmers felt some funding should be provided to them to support personal pig control activities (e.g., those that did not request Boar Busters on their properties, but were managing pigs on their private properties should receive some of the pig control funding). There were additional concerns with the behavior of stakeholders affected by the contract program. Some stakeholders were not satisfied with the on-ground coordinator's ability to communicate with others. Also, because the Terrain program was run by the contractor, there was the sense that the program allowed a lack of ownership by other stakeholders. One stakeholder felt the program would lead to dissatisfaction because the Terrain model would divide the community. Another said that this model was only appropriate for small scale management (e.g., on a small group of properties) and could not function in a larger landscape scale. Some FHT members were indifferent to the program and felt it had no impact on their activities, while others were

vehemently opposed to the program. Hunters and TOs generally felt left out of the program. Hunters who were opposed to the program, were particularly concerned with the loss of valuable hunting sites, because Boar Busters trapping sites often required the closure of some private land to the public or hunters in particular.

The majority of participants liked the idea of chiller boxes, because they provided some financial compensation to recreational hunters for collecting pigs, and provided an added incentive to hunt. They felt a bounty could also serve this purpose. Participants were, however, somewhat wary about the methods used to manage the boxes. There were concerns that pigs might be bred and released to increase the numbers of pigs collected or that the presence of boxes caused an increase in illegal access by hunters keen to collect pigs for sale. Some believed that the termination of the chiller box in the region was the result of an insufficient market for pigs.

The survey of experts in the region generally indicated that those with experience in contract trapping programs preferred this type of management model (Table 3), while those with experience with community trapping models preferred this type of model for management (Table 4). The points with which stakeholders were not completely satisfied, regardless of the program type, were the models' actions, funding, and the sustainability of the results. It is important to note that, while efforts were made to include TO and hunter experts with experience in these kinds of pig control in the survey, there were few representatives of these groups, because few had the opportunity to participate in these kinds of management models.

Table 3. Contract Trapping Program Model survey results. The first column presents the survey questions. Results are from interviews with 26 experts.

Question	% Agree	% Disagree	% Neutral
1. The model is flexible enough to allow it to change when new challenges occur.	72	14	14
2. The model provides satisfactory ways to monitor, evaluate, and change program practices.	68	23	9
3. The model successfully achieves its goals for pig control.	64	18	18
4. The model represents a sustainable management system.	50	27	23
5. The model encourages community stakeholders and government managers to work together in all the steps of the management process.	59	32	9
6. The model encourages stakeholders and government managers to learn together and from each other about pig management.	64	23	14
7. Stakeholders feel they have the right to act and participate in achieving the goals of the model.	59	18	23
8. Stakeholders are representative of those members of the community who are involved in pig control.	72	14	14
9. Stakeholders clearly understand the model's purpose, how it functions and how they can be involved.	64	9	27
10. The model provides adequate opportunities for communication, feedback, and conflict resolution.	73	9	18
11. The model's actions, funding, and results are sustainable.	32	41	27
12. The design and geographical range of the model are suitable for addressing the pig management problem it is intended to resolve.	54	32	14

Table 4. Community-Based Trapping Program Model survey results. The first column presents the survey questions. Results are based on responses from 21 experts.

Question	% Agree	% Disagree	% Neutral
1. The model is flexible enough to allow it to change when new challenges occur.	77	8	15
2. The model provides satisfactory ways to monitor, evaluate, and change program practices.	65	19	15
3. The model successfully achieves its goals for pig control.	54	27	19
4. The model represents a sustainable management system.	54	27	19
5. The model encourages community stakeholders and government managers to work together in all the steps of the management process.	81	8	11
6. The model encourages stakeholders and government managers to learn together and from each other about pig management.	69	15	15
7. Stakeholders feel they have the right to act and participate in achieving the goals of the model.	77	0	23
8. The stakeholders are representative of those members of the community who are involved in pig control.	73	15	11
9. Stakeholders clearly understand the model's purpose, how it functions and how they can be involved.	81	0	19
10. The model provides adequate opportunities for communication, feedback and conflict resolution.	50	23	27
11. The model's actions, funding, and results are sustainable.	39	50	11
12. The design and geographical range of the model are suitable for addressing the pig management problem it is intended to resolve.	54	23	23

Conflict Management Frames

Conflict management frames describe how, under existing conditions, stakeholders choose to manage conflict regarding the pig resource (Gray 2003). There are a number of categories of conflict management frames and these are described in Table 5. Farmers prefer management practices that incorporate joint problem solving between themselves and managers.

For this reason they participate in the various regional pig management programs organized by managers. Farmer acknowledgement of the authoritative power and resource power of managers leads them to request stronger and clearer legislation for the improvement of pig management practices; they particularly wish to see greater commitment to management actions by these managers (appeal to political action). Farmers also ask managers for a sustainable infusion of funds for pig control. They feel that without the added support of managers, management is not possible (appeal to market economy). In line with their value of joint-problem solving, they wish to see funds allocated more evenly between all stakeholder management actions. Additionally, due to the acknowledgement of the power roles of managers, some farmers feel that additional collection of data by managers will demonstrate to them the extent and importance of pig damage and provide them with insight into farmer beliefs and values. They feel that this will provide the evidence managers want and need in order to take greater action (fact-finding).

Many hunters feel they have no voice in the pig management arena and for this reason some resort to the use of a struggle/sabotage/violence frame. They may damage manager tools such as pig traps, and may cut fence locks or dismantled fences and occasionally sabotage management efforts by releasing pigs into management areas in part as a way to demonstrate their dissatisfaction with manager management practices. Managers describe this behavior to be detrimental to the management process. The use of guns and dog hunting on restricted areas where trapping occurred resulted in some trapping delays, because pigs were frightened away from trapping areas. If traps were damaged or removed, delays could result from having to find new traps for the site and the re-initiation of the trapping process. Other hunters feel that engaging managers is a hopeless endeavor and resign themselves to the fact that current practices will remain unchanged (avoidance/passivity). Many have sought to work jointly with managers,

for example, it was a hunter/farmer who designed a trap for one of the regional pig management programs. Hunters generally wish to see changes in legislation that will take into greater consideration the needs of hunters (appeal to political action). They would also appreciate when possible, equitable funding if they do assist managers with their programs (appeal to market economy).

Table 5. Stakeholder conflict management frames. The source of the descriptors is Gray's model of frame analysis (Gray 2003). This table presents the kinds of conflict management solutions used by various stakeholders. Conflict management descriptors are: fact-finding- get more information; joint problem solving-work together with all stakeholders to find solutions; appeal to political action- government needs to do something to illicit change; appeal to market economy- there should be a change in the economy, e.g., incentives for management; struggle/sabotage/ violence- destruction of property and breaking of rules to protest current management regulations; avoidance/passivity- do nothing: this is elicited by a sense of apathy, a desire to leave things as they are, lack of drive for change, or else hopelessness; authority decides on expertise- managers should decide based on specialized knowledge skills; and others need to act- someone else needs to create management decisions and actions.

Stakeholder	Conflict Management Frames
Farmer	fact-finding, joint problem solving, appeal to political action, appeal to market economy
Hunter	struggle/sabotage/ violence, avoidance/ passivity, joint problem solving, appeal to political action, appeal to market economy
TO	authority decides, appeal to political action, avoidance/passivity, joint problem solving, appeal to market economy
Managers	avoidance, fact-finding, authority decides, appeal to political action, others need to act*: other conflict management modes
Government Representatives and On-Site Pig Manager	appeal to political action, appeal to market economy

* My addition

TOs are happy for government managers to take a leading role in the management process (authority decides), but they would like to be at least consulted in the management

planning phase (joint problem solving). One of these TOs had begun the process of attempting to engage with a manager specifically for the purpose of participating in pig management. The others however, felt disillusionment due to past attempts and failures to engage with managers and so they practice avoidance/passivity frames. They wait to see what will happen and if managers will eventually engage with them. TOs feel that if they are engaged, they need sufficient funds to be able to enact management proposals (appeal to market economy).

Some managers avoid the subject of stakeholder participation in pig management and focus on their on-ground practices (avoidance). They use research and the literature to determine how to manage pigs on the ground and use media to inform the public about pig legislation, salient research information about pigs, and on occasion to inform the public about pig management actions they have undertaken (fact-finding). Managers generally base their actions on the legislation passed down to them by officials, the direction of other managers and knowledge they have collected over time (authority decides based on expertise). Some see a need for change in the interactions between local stakeholders and themselves and hope for changes in legislation that might make such interactions easier (appeal to political action). Managers generally feel that farmers should take more responsibility for pig control (others need to act). In the realm of management programs, they feel management planning and actions are and should be determined using scientific knowledge and that those with formal authority are and should ultimately be responsible for formal pig control programs. The community can serve in roles of advising and assisting in some decision-making. Pigs are not considered to be a top priority so pig management actions may be sporadic with other more important management issues taking precedence in daily actions and decisions. Some feel that legislation should be more flexible to allow managers more freedom in the selection of tools used for pig control.

Government representatives generally felt that managers and higher level government officials needed to pay more attention to pig management and pig resource users and indicated that part of their process was to appeal to these managers and officials for support (appeal to political action). Linked to the need for more manager and government support, these representatives felt more funding, particularly sustainable funding, should be allocated to pig management (appeal to market economy).

Discussion

A Landscape Divided

The perception of the relationship between feral pigs and the landscape in which they reside is one of the defining influences in how stakeholders manage the resource. Hunters, TOs, and the majority of farmers recognize that pigs are a moving resource. Inherent in their management planning process is the recognition of the movement patterns of pigs and that the occupation of pigs on the landscape is dependent on ecosystem variations. Members of the Farmer/Hunter/TO social structure (FHT) believe they have a sense of how pigs move (e.g., the idea of source and sink populations in the landscape and an awareness of the types of habitats pigs prefer). Some farmer management actions- electric fences and fallow plots- are used as pig deterrents; farmers recognize that these do not impact pig populations, but instead farmers take advantage of pig movements to try to direct pigs away from their properties and into other areas.

The multi-pronged approach of farmers captures pigs on farm properties, using control tools on these properties. However, whenever neighbors work together to facilitate management, set traps on the outside edges of their properties, or allow hunters to travel between properties, they recognize the holistic nature of the socio-ecological resource complex. The same is true of

hunters traveling between properties and/or into forested areas and of TOs hunting beyond the bounds of their lands or allowing managers or outside hunters onto their lands to manage pigs. They recognize the ecosystem equilibrium inherent in the socio-ecological system in which they live**.**

Regardless of whether their perceptions of the ways pigs move in the landscape are all accurate- because there are many managers who disagree with some of these perceptions- what is fundamental is that they recognize the ecological equilibrium of the landscape and as much as possible manage pigs under this principle. Pig management practices used within the formal system of managers tends to follow traditional management theory based on the desire to follow patterns of equilibrium resilience.

Managers attempt to simplify the management of socio-ecological systems by reducing the scope of the system; they deliberately reduce the way the system is structured or functions in an effort to increase the amount of stability or predictability of the system (Holling and Meffe 1996). This reduction can be based on personal beliefs or else be required by legislation and policy. This may initially produce the desired result, but is not sustainable as the process of attempting to maintain a static equilibrium ultimately causes the loss of ecological resilience- the ability of the system to adapt to disturbance- and can lead to at least a partial collapse of the system the management practice attempts to maintain (Holling and Meffe 1996). Government policy for the management of feral pigs follows just such a strategy. Pig management is simplified spatially by tying the pig resource to particular parcels of land and basing management policy on this bounded area.

In order to simplify the large and complex problem of how to manage the landscapes in which they reside, managers focus on maintaining a degree of equilibrium in the landscapes in

which they work. They manage within the political boundaries of their management areas. Managers function occasionally outside these boundaries, but primarily only when required by FHT members. The total pig populations considered are those 'bound' by imaginary barriers within the parameters of the public lands in questions; pigs become stationary objects. The challenges associated with the management of pigs within rainforest areas are simplified by ignoring the complex topography of the rainforest. There is no attempt to manage pigs within the forest; instead, management tools are used almost exclusively along established manmade pathways. This simplification of management issues may also contribute to the poor relationship between managers and other stakeholders. Managers include stakeholders in programs who they see as fitting particular criteria and exclude others as if they do not exist. The use of equilibrium resilience as a core principle, which uses traditional scientific knowledge systems to manage people, may also be part of the reason some coordinators are unable to communicate well with other stakeholders.

This system of thinking is not just a feature of pig management in Queensland, much less Australia, but of management practices for natural resources in general. In Newfoundland, for example, prior to the collapse of the North Atlantic cod fishery, inshore fishers warned biologists that spawning stocks in their fishing areas were dangerously low. Resource manager estimates of cod populations were spatially limited to offshore fish stocks and so they ignored fisher warnings and the ultimate result was the demise of these fish populations (Berkes and Folke 2000; Finlayson and McCay 1998). Another example comes from Finland where the Ministry of Agriculture and Forestry (MAF) organized a panel of primarily biology and ecology experts to evaluate forest use in Southern Finland (Hellstrom 2006). The panel neglected to consider any economic or social influences on forest use and reported recommendations based on this

evaluation process. It was intended that a multiple stakeholder group would then make decisions about management actions based on these recommendations, but local stakeholders refused to cooperate because they had not been allowed to participate in the evaluation process. Due to this response, the government ultimately denied the panel the right to continue through to the end of the decision-making process (Hellstrom 2006).

One of the great frustrations of FHT members is that according to formal government legislation, they are not allowed to recognize ecological equilibrium in their management practice. The use of dogs in landscapes that are otherwise inaccessible, defying land tenure regulations to cross private borders and manage pigs in public lands are all recognized by formal institutions as illegal practices. These actions by FHT members reflect their attempt to follow a program that supports ecological equilibrium, but it also represents FHT member efforts to compensate for what is considered "ineffective formal institutions" (Helmke and Levitsky 2004). FHT members act where managers do not; the FHT structure may operate outside the bounds of the formal or legal rules, for example, by hunting pigs with dogs in national parks or FHT members may act in a substitutive manner to complement existing manager strategies (e.g., using electric fences or trapping pigs on farms; Helmke and Levitsky 2004).

The frustration felt by FHT members however, is also shared by some on-ground managers. The formal institutions of government do not always allow mangers to act as they wish and recognize the inherent complexity of the socio-ecological system in which they function. The ultimate management problem that results is that formal management practices do not recognize the influence of disturbance on the system and the actions of managers to maintain equilibrium resilience causes a reduction of resilience in the system which can ultimately lead to a flip in the system. The actions of managers to control feral pigs lack sustainability. FHT

member actions reflect the sense that FHT members feel that the manager structure lacks legitimacy (Ostrom 1990, 2000; Steins and Edwards 1999). The conflict that results from the disparity in the philosophy and practice of the two groups competing over the use of the feral pig resource also encourages the breakdown of the feral pig management system.

Management Planning And Participation; Learning From Past Examples

The major concerns about management planning described by stakeholders relate to program funding and sustainability, coordination, the ability of coordinators to perform their jobs, and participation. Like the management of landscapes themselves, government legislation simplifies the funding process spatially and temporally. Funding for feral pig management can be divided spatially by region and it is divided temporally by being provided incrementally or as a finite payment offered at a particular time of year or for a particular timeframe. Actual on-ground management actions often do not coincide neatly with funding cycles; funds may either be subsumed before the completion of management actions or else, as a finite payment, funds may not offer sufficient coverage to complete the project. Stakeholders believed this was one of the causes for the demise of the community trapping program- the finite payment of funds did not meet the on-ground management needs. Managers attempted to devise a financially self-sufficient program when they initiated the Terrain contract management program (Noble 1996). The initial trial period was subsidized by government funding and stakeholders were concerned about the longevity of the funding for this program due in part to high running costs.

Sustainability concerns were tied to funding, but also to concerns about a management program's ability to maintain itself even in the presences of low pig populations and its ability to maintain the engagement of stakeholders throughout the management process. Effective coordination and financial incentives were described as important to the sustainability of

management programs. The use of a contract trapping program by Terrain was initiated, in part, as an effort to compensate for some of the project coordination problems that some believed were one of the underlying causes that led to the breakdown of the community trapping program (Noble 1996). The contract trapping program attempted to reduce arenas for conflict by reducing stakeholder involvement in on-ground actions. Meanwhile, the program attempted to maintain some of the stakeholder diversity by including multiple stakeholders on the decision-making panel. The problem described by stakeholders with this format was that the program does not recognize the on-ground management contributions of stakeholders other than the contract trapper, and that it does not include all interested stakeholder groups in the decision-making process. The program, therefore, fails to coordinate overlapping management activities in the region.

The ability of program coordinators themselves was described as having a significant impact on the project organization. Coordinators involved in the Community Based Feral Pig Trapping Program were praised for their abilities to interact and coordinate stakeholders and derided if they were unable to understand or manage stakeholders involved in the management process. Scheff (2005) describes a key element for successful discourse to be 'mutual awareness'. Mutual awareness is about "not only understanding the other, but also understanding that one is understood, and vice versa" (Scheff 2005; see Chapter 3).

Pigs are a moving resource that transects property boundaries and the use of pigs in one property affects the presence of pigs on others. Participation is a key component for maneuvering the complexity of such socio-ecological systems and participant feedback can provide a way to monitor the success of the management of these systems (Berkes and Folke 2000). According to study results, there were proponents for both the community based and contract trapping models

in both the manager and FHT social structures. There was no dominant model preference in either group. There was a different kind of preference however, a preference for greater participation. Stakeholders attribute the failure of previous pig management programs in part to lack of participation or weak participation practices. Noble (1996) also describes inadequate integration of community into the Sustainable Best Practice Feral Pig Management Project as a cause of failure in the project. Managers demonstrated a desire to see farmers take a greater role in pig management. FHT members identified themselves as already having a role in pig management and they all expressed the desire to be involved in pig management planning. While stakeholder definitions of participation may differ, both social structures consider participation to have a role in pig management.

Managers describe a spectrum of community engagement involved in their practice. Similarly, the literature on public participation describes typologies of participation of different scales (Arnstein 1969.; Cohen and Uphoff 1980; Pimbert and Pretty 1994). Public participation is considered an essential component to successful management practices (Beierle and Cayford 2002; Eden 1996; International Association for Public Participation 1997; Siemer and Decker 1990). Yet, despite managers describing the use of various levels of participation, the farmers, hunters, and TOs remain dissatisfied with the level of engagement. This kind of discrepancy can also be found in adaptive management literature.

One of the principle tenets of adaptive management practice is public participation (Fernandez-Gimenez et al. 2008; McLain and Lee 1996; Stankey et al. 2003; Stringer et al. 2006; Susskind et al. 2012). Yet, despite this, there has been much management failure regardless of the integration of the key component of participation (Adams and McShane 1996; Averbeck 2006; Berkes and Folke 2000; Bonham et al. 2008; Brosius and Russell 2003). The case of initial

Integrated Conservation Development Projects (ICDP) provides an example of this kind of management failure. These programs were launched in the 1980s and were created with the sentiment that for management to succeed, particularly in the case of protected areas such as national parks, it is necessary to combine a development component to assist communities bordering these areas (Hughes and Flintan 2001). The idea was that by satisfying development needs, communities would support the conservation goals of the parks however, many of these initial programs failed. There were many reasons for this failure, but one of the principle reasons was the way in which participation was implemented. These programs tended to continue to use traditional principles in their practices. Community tended to be integrated into programs using strategies of passive participation or participation in information giving; in these forms of participation, participants are told how a program will occur or officials will collect information-through such methods as surveys-without input from local communities. Communities were not given the opportunity to determine or influence the direction or activities of the project (Adams and McShane 1992; Hughes and Flintan 2001; IIED 1994; Newmark and Hough 2000).

Adaptive management (AM) is meant to be a flexible process that is able to respond to the needs of participants involved in a study. This flexibility leaves room in a study for individual creativity, interests, and differences in cultures to manifest themselves. However, this generous flexibility in process also may leave some aspects of AM to be somewhat ambiguous. The role of participation in AM practice is an example of this ambiguity. There is space left in the definition of participation as it is used in AM so that it can be easily molded to every study, but the definition of participation is so broad that the ambiguity can result in the loss of significance of the term, because it is redefined in every study. One of the reasons for

management failure in these arenas, and in the management of pigs specifically, is the failure to concretize a basic standard of principles for participation.

One example of participation failure comes from the attempt to incorporate TO interests into the management of turtles and dugongs in the Great Barrier Reef Marine Reserve in Australia (Resource Assessment Commission 1993). Management officials attempted to account for TO needs to continue hunting these endangered species by granting hunting licenses to any indigenous person, yet TOs claimed that licenses should be restricted to those who belong to the sea and land of the coastal reef and not to those from farther inland who have no spiritual connection to the reef areas. Granting permits to outside TO groups encourages the illegal sale and poaching of marine animals because these people have no spiritual connection or ties to the traditional laws that restrict the hunting of dugong and turtles in reef areas. Many TO groups felt that GBRMPA lacked a basic cultural understanding of the reef peoples and failed to acknowledge essential indigenous knowledge and practices for conservation of the dugong and turtles (Resource Assessment Commission 1993). Additionally, there is the need to consider how much participation is required at various points in the management process.

FHT members had a flexible sense of participation; they had a desire for different levels of participation for different aspects of practice in the pig management process. In the case of TOs, this was sometimes misconstrued by managers as a lack of interest. Even during the course of conducting my research, I found that FHT members were more interested in participating in some parts of my study than others. Managers may struggle to determine how, and in which parts of projects they should incorporate participants. Managers may include the simple cooptation of knowledge from a group of people as participation, or where the reins of control over a project are handed over, forced on or taken from one group of participants, this also may be considered

to fit the definition of participation. The problem is, that without clearly operationalizing the term 'participation', there is too much room left for the term to be misused resulting in a process that is made overly complicated at best or oppressive at worst. The degree of acceptable participation by study members must be determined by all the members together; not by just one group of participants or one individual. Members should decide together where, when, and how much each individual or group is willing to participate. Participation must be defined as a voluntary activity in which the abstraction 'voluntary' is operationalized as 'acting of one's self' where a person has the opportunity to weigh information presented to them and decide, without the intervention of force, to be involved in a project or not.

Transparency in the research process is central to participation; members must be on the same footing and must all have central knowledge that is core to a project (Bernard 2006; Cornwall and Jewkes 1995; Greenwood and Levin 1998; Herr and Anderson 2005). FHT members described a certain level of confusion about the various management programs and their actions to the extent that some FHT members were not aware of the existence of these programs in their region. This may be a function of poor communication, but also of a lack of transparency in the research process; some managers described using notices in newspapers to inform the public of management actions only after or days before the action occurred. Additionally, information provided to the public frequently did not provide detailed descriptions of management practices.

Some pig management programs that intended participation failed to include all relevant stakeholder groups. The use of struggle/sabotage/violence frames by some hunters reflects that despite the importance of pig management to this group, they are excluded from management practices. It is important to consider 'arenas of participation' in formal management practice.

Action research proposes the use of arenas of communication- these are physical spaces- where participants, whether they are the initiating investigator of a study or other participants in a project, can gather to talk about the study subject (Bernard 2000; Greenwood and Levin 1998; Russell and Harshbarger 2003).

This concept of arenas of communication can be used as a basis to define another criterion for participation. I believe 'arenas of participation' should be specifically considered. Arenas of communication focus on creating comfortable spaces to engage stakeholders who have already been recruited to a project. Arenas of participation focus on more inclusive arenas for the actual recruitment and better representation of the diversity of relevant community stakeholders. My definition of an arena of participation focuses on the groupings of individuals gathering in a space to communicate. The idea is that, if necessary, multiple spaces can be created so that all relevant stakeholders find at least one meeting space in which they feel comfortable participating. During the course of my research, I organized for farmers to meet me at a local council building where they were accustomed to gather for other purposes, but I met hunters at my home for a barbeque because privacy is very important to this group and meeting at the council building would reduce the likelihood of hunter presence. Similarly, in some communities in Cameroon, women dominate in the house and control activities that occur within the home, but outside the house in communal spaces men dominate. In a mixed group meeting outside the home, women may not participate, simply deferring to the men. If however, at some stage, two separate meetings are held, one for women in the home and one for men outside it, individuals may be more likely to participate (De Merode and Cowlishaw 2006; Ellis 2004; Russell and Harshbarger 2003; G. Shuster, unpublished).

It seems then, that guidelines for participation in AM must include:

- a transparent co-generative learning space
- voluntary involvement
- arenas of communication and arenas of participation
- determination of the amount and timing of participation through input from all interested group participants

The ultimate purpose of concretizing principles of participation would be to retain flexibility in the AM process while providing some uniformity to the definition so as to simplify the process of delineating its parameters. A more bounded definition may also help to retain the ethic behind participation in AM so that the term is not abused and used to disguise an oppressive process. Such a use of participation in natural resource management and feral pig management in particular might assist in the improvement of management outcomes.

Threatened Protected Areas And Feral Pigs

The concepts of landscape integrity and participation in the examination of feral pig socio-ecological systems demonstrate important factors that also contribute to the failure of threatened protected areas (TPAs). The failure of TPAs is often ascribed to external influences such as lack of resources, including funding and staffing, and competition with development (Bonham et al. 2008). Some of the underlying causes are described as cultural discrepancies, migration and population density, and particular policy decisions (Geist and Lambin 2002). While one of the factors considered to lead to the failure of feral pig management programs was the need for sustainable funding, in the short term, funds were available to manage pigs as desired, but all stakeholders criticized the way funding was allocated. Studies have shown that the simple injection of funds into an environmental management program is not sufficient to

guarantee its success (Hockings et al. 2006; Rydin 2003; Stoll-Kleemann 2001). I would suggest that one of the most important causes of failures in TPAs is the use of equilibrium resilience practice in the management of these areas. This practice divides the landscape and leads to less effective use of available management strategies and resource management tools. One example of this kind of division in a TPA is the case of Lake Mburo National Park (LMNP) in Uganda (Averbeck 2006).

Lake Mburo was considered one of the most import areas of wildlife diversity in East Africa in the 1930s. In 1983, LMNP was declared a reserve and all forms of land tenure, traditional or otherwise, were terminated without any input from the local community. Local stakeholders who refused to leave were forcibly removed. Neighboring community members were expected to respect the knowledge system of managers; the concept was for the new designation to create an imaginary, theoretical boundary around the park to protect the wildlife within. It was a way of simplifying the landscape for easier management. The park began to behave as a TPA. Stakeholders quickly moved back into the area. The ultimate result was stakeholders living in and around the park, a decline in wildlife populations, and significant conflict in land use (Averbeck 2006).

After residents were allowed to claim ownership of wildlife under certain conditions, Averbeck (2006) developed a participatory project that included research into the viability of impala harvesting to sell meat for profit. Once the study was completed, and despite a lack of outside funding, local stakeholders used their own resources to establish the Rurambira Wildlife Association (RWA) and continued the cropping and wildlife management program. These stakeholders supported park management efforts by reporting poachers to law enforcement officers. RWA organized a sports hunting program on ranches boarding the LMNP with the

approval of the Ugandan Wildlife Authority (UWA). The program was owned and managed by local communities and profits returned to the community and the park. The merging of already established government tools and management efforts with those of local stakeholders through the new program led to an increase in wildlife populations. Additionally, land right disputes declined as did poaching while community profits increased. The UWA, in association with the RWA, went on to assist neighboring communities in establishing similar programs (Averbeck 2006).

This study demonstrates how the use of equilibrium resilience practices can mask the importance of stakeholder groups and the movement of resources through the landscape and, in turn, can contribute to poor management outcomes. The case described by Averbeck (2006) also demonstrates the relevance of participation. Public participation is a tool that can serve to maintain a more reflexive system through feedback processes. Management practices that fail to incorporate adequate participatory processes can also lead to dissatisfactory management outcomes. The incorporation of diverse stakeholders can serve to unify the management of a resource system by reflecting the multiple ways the resource is used in the ecosystem and also the multiple habitats in which it is utilized. The use of ecological resilience practices and carefully concretized principles of public participation may serve to improve the management of feral pigs, TPAs, and natural resources in general far more than any injection of funds or policy changes that might simply function to maintain principles of equilibrium resilience practices.

Literature Cited

Adams, C. E., B. J. Higginbotham, D. Rollins, R. B. Taylor, R. Skiles, M. Mapston, and S. Turman. 2005. Regional perspectives and opportunities for feral hog management in Texas. Wildlife Society Bulletin **33**:1312-1320.

Adams, J. S., and T. O. McShane 1996. The Myth of Wild Africa: Conservation Without Illusion. University of California Press, NY.

Akbulut, B. 2012. Community-Based Resource Management in Turkey: 'Je Participe, Tu Participes, Il Participe… Ils Profitent'1. Development and Change **1**:1-26.

Animal Health Australia. 2005. Wild Animal Response Strategy: Australian Veterinary Emergency Plan. Primary Industries Ministerial Council, Canberra, ACT.

Arnstein, S. R. 1969. A ladder of citizen participation. Journal of the American Institute of Planners **35**:216-224.

Attorney General's Department. 2012. Native Title Act 1993, Act No. 110 of 1993 as amended in Attorney General's Department, editor. Office of Legislative Drafting and Publishing, Attorney General's Department, Canberra, ACT.

Averbeck, C. 2006. Incorperating local people through economic incentives at Lake Mburo National Park, Uganda- Africa Works! Pages 325-343 in S. Stoll-Kleemann, and M. Welp, editors. Stakeholder Dialogues in Natural Resources Management: theory and practice. Springer, New York.

Bauer, J., and J. Giles. 2002. Recreational Hunting an International Perspective Wildlife Tourism Research Report Series: No. 13: Status Assessment of Wildlife Tourism in Australia Series. CRC for Sustainable Tourism Pty Ltd, Australia.

Beierle, T. C., and J. Cayford 2002. Democracy In Practice: Public Participation In Environmental Decisions. Resources for the Future, Washington, D.C.

Benford, R. D., and D. A. Snow. 2000. Framing processes and social movements: an overview and assessment. Annual Review of Sociology **26**:611.

Benford, R. D., and D. A. Snow. 2005. Clarifying the relationship between framing and ideology. Pages 205-211 in H. Johnston, Noakes, John A. , editor. Frames of protest: social movements and the framing perspective. Rowman & Littlefield Publishers, Inc., Oxford, UK.

Berkes, F., and C. Folke 2000. Linking Social and Ecological Systems. Cambridge University Press, Cambridge, UK.

Bernard, H. R. 2000. Social Research Methods: Qualitative And Quantitative Approaches. Sage Publications, Inc., Thousand Oaks, CA.

Bernard, H. R. 2006. Research Methods In Anthropology: Qualitative And Quantitative Approaches. AltaMira Press, NY, NY.

Bihari, M., and R. Ryan. 2012. Influence of social capital on community preparedness for wildfires. Landscape and Urban Planning **106**:253-261.

Boar Busters. 2009. Boar Busters Quarterly Report for IFPP Tully/Murray Catchment January-March 2009. Page 27 in P. Smith, editor. Boar Busters for Terrain Natural Resource Management, Tully, QLD.

Bomford, M., and J. Caughley 1996. Sustainable Use of Wildlife by Aboriginal Peoples and Torres Strait Islanders. Australian Government Publishing Services, Canberra, ACT.

Bonabeau, E. 1998. Social insect colonies and complex adaptive systems. Ecosystems **1**:437-443.

Bonham, C., E. Sacayon, and E. Tzi. 2008. Protecting imperiled "paper parks": potential lessons from the Sierra Chinajá, Guatemala. Biodiversity and Conservation **17**:1581-1593.

Booth, W. C., G. G. Colomb, and J. M. Williams 1995. The Craft Of Research. University of Chicago Press, Chicago, IL.

Bourne, L., and D. H. T. Walker. 2005. Visualising and mapping stakeholder influence. Management Decision **43**:649-660.

Brosius, J. P., and D. Russell. 2003. Conservation from Above: An Anthropological Perspective on Transboundary Protected Areas and Ecoregional Planning. Journal of Sustainable Forestry **17**:39.

Campbell, T. A., and D. B. Long. 2009. Feral swine damage and damage management in forested ecosystems. Forest Ecology and Management **257**:2319-2326.

Carey, C., N. Dudley, and S. Stolton. 2000. Squandering paradise? The importance and vulnerability of the world's protected areas. Pages 1-232 in WWF, editor. WWF-World Wide Fund For Nature, Gland, Switzerland.

Carpenter, S., M. Walker, J. Anderies, and N. Abel. 2001. From metaphor to measurement: resilience of what to what? Ecosystems **4**:765–781.

CCRC. 2011. Tropical Futures 2016: Pillars For A Sustainable Cassowary Coast. Pages 1-52, Innisfail, Qld.

Choquenot, D., J. Mcllroy, and T. Korn. 1996. Managing Vertebrate Pests: Feral Pigs. . Bureau of Resource Sciences, Canberra, ACT.

Christensen, J. 2004. Win-Win Illusions. Conservation in Practice **5**:12-19.

Cohen, A., and G. Uphoff. 1980. Participation's place in rural development: seeking clarity through specificity. World development **8**:213-235.

Cornwall, A., and R. Jewkes. 1995. What is participatory research? Social Science and Medicine **41**:1667-1676.

Crome, F. H. J., and L. A. Moore. 1988. The southern cassowary in north Queensland- a pilot study. Queensland National Parks and Wildlife Service and the Australian National Parks and Wildlife Service, QLD.

Crutchfield, J. P. 1994. The calculi of emergence:computation, dynamics, and induction. Physica D **75**:11-54.

De Figueiredo, C. C. M. 2007. From paper parks to real conservation: case studies of national park management effectiveness in Brazil. Ohio State University.

De Merode, E., and G. Cowlishaw. 2006. Species protection, the changing informal economy and the politics of access to the bushmeat trade in the Democratic Republic of Congo. Conservation Biology **20**:1262-1271.

De Santo, E. M. 2012. From Paper Parks to Private Conservation: The Role of NGOs in Adapting Marine Protected Area Strategies to Climate Change. Journal of International Wildlife Law & Policy **15**:25-40.

Department of Sustainability, E., Water, Population and Communities 2011. The feral pig (*Sus scrofa*), Canberra, ACT.

Dewulf, A., B. Gray, L. Putnam, R. Lewicki, N. Aarts, R. Bouwen, and C. van Woerkum. 2009. Disentangling approaches to framing in conflict and negotiation research: A meta-paradigmatic perspective. Human Relations **62**:155-193.

Douglas, L., A. Roberts, and R. Thompson 1988. Oral History: A Handbook. Allen and Unwin Australia Pty Ltd, Sydney, NSW.

Dreyfus, H. L., P. Rabinow, and M. Foucault 1983. Michel Foucault, Beyond Structuralism and Hermeneutics. University of Chicago Press, Chicago, IL.

Dwyer, P. D. 2006. People, pigs and parasites in New Guinea: Relational contexts and epidemiological possibilities. Parasitology International **55**:S167-S173.

Eden, S. 1996. Public participation on environmental policy: considering scientific, counter-scientific and non-scientific contributions. Public Understanding of Science **5**:183-204.

Ellis, C. 2004. The Influential Role Of Women In The Commercial Bushmeat Trade In Cameroon. Brookfield Zoo, Chicago, Il.

Fernandez-Gimenez, H. L. B. M. E., and V. E. Sturtevant. 2008. Adaptive management and social learning in collaborative and community-based monitoring: a study of five community-based forestry organizations in the western USA. Ecology and Society **13**:4.

Finlayson, A. C., and B. J. McCay. 1998. Crossing the threshold of ecosystem resilience: the commercial extinction of northern cod. Pages 311-337 in F. Berkes, and C. Folke, editors. Linking social and ecological systems: management practices and social mechanisms for building resilience. Cambridge University Press, Cambridge, UK.

Firey, W. I. 1960. Man, Mind and Land: A Theory Of Resource Use. Free Press, Glencoe, Il.

Folke, C. 2006. Resilience: The emergence of a perspective for social-ecological systems analyses. Global Environmental Change **16**:253-267.

Forgas, J. P., and K. D. Williams 2001. Social Influence: Direct and Indirect Processes. Psychology Press, Philidelphia, PA.

Foucault, M. 1972. The archaelogy of knowledge. Routledge, London.

Foucault, M. 1980. Power/Knowledge:selected interviews and other writings by Michel Foucault, 1972-1977. Harvester, Brighton, England.

Gardner, G. T., and P. C. Stern 2002. Environmental problems and human behavior Pearson Custom Publishing, Boston, MA.

Garmestani, A. S., C. R. Allen, and L. Gunderson. 2009. Panarchy: discontinuities reveal similarities in the dynamic system structure of ecological and social systems. Ecology and Society **14**:15.

Geist, H. J., and E. F. Lambin. 2002. Proximate Causes and Underlying Driving Forces of Tropical Deforestation. BioScience **52**:143-150.

Gibson, C. C., and S. A. Marks. 1995. Transforming Rural Hunters into Conservationists: An Assessment of Community-Based Wildlife Management Programs in Africa. World Development **23**:941-957.

Girringun Aboriginal Corporation. 2012. About Us: What is Girringun?, Cardwell, QLD.

Goffman, E. 1959. The presentation of self in everyday life. Doubleday, Garden City, N.Y.

Goffman, E. 1974. Frame Analysis:An essay on the organization of experience. Harper, New York

Gray, B. 2003. Framing of Environmental Disputes. Pages 11-34 in R. Lewicki, B. Gray, and M. Elliot, editors. Making Sense of Intractable Environmental Conflicts: Concepts and Cases. Island Press, Washington, D.C.

Greenwood, D. J., and M. Levin 1998. Introduction to Action Research: Social Research for Social Change. Sage Publications, Inc., , Thousand Oaks, CA.

Gunderson, L., and C. Holling 2002. Panarchy: understanding transformations in human and natural systems. Island Press, Washington, DC.

Habermas, J. 1975. Legitimation Crisis. Beacon, Boston.

Hall, S., editor. 1997. Representation: cultural representations and signifying practices. Sage Publications, Ltd., London, UK.

Hanke, R. C., B. Gray, and L. L. Putnam. 2002. Differential Framing of Environmental Disputes by Stakeholder Groups. SSRN eLibrary.

Hanneman, R. A., and M. Riddle. 2005. Introduction to social network methods. University of California, Riverside Riverside, CA.

Harvey, J. 1998. Evaluation Cookbook. Learning Technology Dissemination Initiative Institute for Computer Based Learning Heriot-Watt University, Edinburg, UK.

Hassall and Associates Pty Ltd. 1996. Economic evaluation of the role of bounties in pest management. Vertebrate Pest Program, Bureau of Resource Sciences, Canberra

Hellstrom, E. 2006. Science in support of the Forest Biodiversity Programme for Southern Finland. Pages 241-260 in S. Stoll-Kleemann, and M. Welp, editors. Stakeholder dialogues in natural resources mangement: theory and practice. Springer, New York.

Helmke, G., and S. Levitsky. 2004. Informal Institutions and Comparative Politics: A Research Agenda. Perspectives On Politics **2**:725-740.

Henzell, T. 2007. Australian agriculture: its history and challenges. CSIRO Publishing, Collingwood, Victoria.

Herr, K., and G. L. Anderson 2005. The action research dissertation: A guide for students and faculty. Sage, Thousand Oaks, CA.

Hide, R. 2003. Pig husbandry in New Guinea: A literature review and bibliography. Page 209 in A. Monograph, editor. Australian Centre for International Agricultural Research, Canberra.

Hillier, K. 2002. Community Based Feral Pig Trapping Program: Review of Program 1993-2002. Department of Natural Resources and Mines, Brisbane, QLD

Hockings, M., S. Stolton, F. Leverington, N. Dudley, J. Courrau, and P. Valentine. 2006. Evaluating effectiveness:a framework for assessing managemnet effectiveness of protected

areas. Page 87 in IUCN, editor. Best Practice Protected Area Guidelines Series No. 14. IUCN, Gland, Switzerland.

Holling, C. S. 1973. Resilience and stability of ecological systems. Annu Rev Ecol Syst **4**:1-23.

Holling, C. S., and G. K. Meffe. 1996. Command and Control and the Pathology of Natural Resource Management. Conservation Biology **10**:328-337.

Hone, J. 2002. Feral pigs in Namadgi National Park, Australia: dynamics, impacts and management. Biological Conservation **105**:231-242.

Hone, J., and G. E. Robards. 1980. Feral pigs: ecology and control Wool Technology and Sheep Breeding **28**:7-11.

International Association for Public Participation. 1997. Core values for the practice of public participation. The Practitioner **10**:15-23.

Izac, A. M. N., and P. O'Brien. 1991. Conflict, uncertainty and risk in feral pig management Australian approach. Journal of Environmental Management **32**:1-18.

Jentoft, S., T. C. Son, and M. BjÃ¸rkan. 2007. Marine Protected Areas: A Governance System Analysis. Human Ecology **35**:611-622.

Johnston, H., and S. Lio. 1998. Collective behavior and social movements in the postmodern age: Looking backward to look forward. Sociological Perspectives **41**: 453-472.

Johnston, H., and P. E. Oliver. 2005. Breaking the frame. Pages 213-216 in H. Johnston, Noakes, John A. , editor. Frames of protest: social movements and the framing perspective. Rowman & Littlefield Publishers, Inc., Oxford, UK.

Katz, N., D. Lazer, H. Arrow, and N. Contractor. 2004. Network Theory and Small Groups. Small Group Research **35**:307-332.

Laun, C. H. 1971. A Guide to the Removal of Bounties. in R. C. M. W. E. Fund, editor.

Lewicki, R., B. Gray, and M. Elliot, editors. 2003. Making Sense of Intractable Environmental Conflicts: Concepts and Cases. Island Press, Washington, D.C.

Luyet, V., R. Schlaepfer, M. B. Parlange, and A. Buttler. 2012. A framework to implement Stakeholder participation in environmental projects. Journal of Environmental Management **111**:213-219.

Maguire, L. A. 2004. What Can Decision Analysis Do for Invasive Species Management? Risk Analysis **24**.

Marks, S. A. 1984. The Imperial Lion: Human Dimensions Of Wildlife Management In Central Africa. Westview Press, Boulder, Colorodo.

Mason, R. J., and P. J. S. Fleming. 1999. Australian hunters and the surveillance of feral pigs for exotic diseases. Wildlife Society Bulletin **27**:395-402.

Matthes, J. R. 2009. What's in a frame? A content analysis of media framing studies in the world's leading communication journals, 1990-2005. Journalism & Mass Communication Quarterly **86**:349-367.

McCarty, C., J. Molina, x00E, Luis, C. Aguilar, and L. Rota. 2007. A Comparison of Social Network Mapping and Personal Network Visualization. Field Methods **19**:145-162.

McCay, B. J. 1996. Common and private concerns. Pages 111-126 in S. S. Hanna, C. Folke, and K.-G. Mäler, editors. Rights to nature: ecological, economic, cultural, and political principles of institutions for the environment. Island Press, Washington, D.C.

McGaw, C. C., and J. Mitchell. 1998. Feral Pigs (Sus scrofa) In Queensland in Department Of Natural Resources And Mines, editor. Pest Status Review Series-Land Protection, QLD.

McLain, R. J., and R. G. Lee. 1996. Adaptive management: Promises and pitfalls. Environmental Management **20**:437-448.

Mcllroy, J. C. 1993. Feral pig Management In The Wet Tropics Of Queensland World Heritage Area. Final Report to the Wet Tropics Management Authority Cairns. CSIRO, Canberra, ACT.

Miles, M. B., and A. M. Huberman 1994. Qualitative Data Analysis: An Expanded Sourcebook. SAGE Publications, Inc Thousand Oaks, CA.

Mills, J., Y. Chapman, A. Bonner, and K. Francis. 2007. Grounded theory: a methodological spiral from positivism to postmodernism. Journal of Advanced Nursing **58**:72-79.

Minsky, M. 1975. A framework for representing knowledge. Pages 211–277 in McGraw-Hill, editor. The psychology of computer vision. Winston, P.H., New York.

Morgan, D. L. 1997. Focus Groups As Qualitative Research. Sage Publications, Inc., London.

Noble, K. 1996. Sustainable best practice feral pig management in Queensland wet tropics: Final Report To The Vertebrate Pest Program, Townsville, Australia.

Noble, K. 2007. Terrain NRM Integrated Feral Pig Management Model. Page 2. Terrain Natural Resource Management, Tully.

O'Brien, P. H. 1987. Socio-economic and biological impact of the feral pig in New South Wales: An overview and alternative management plan. The Australian Rangeland Journal **9**:96 – 101.

Office of the Queensland Parliamentary Counsel. 2011. Land Protection (Pest and Stock Route Management) Act 2002, Brisbane, QLD.

Office of the Queensland Parliamentary Counsel. 2012. Land Act 1994. Page 531. Office of the Queensland Parliamentary Counsel.

Oliver, P. E., and H. Johnston. 2005. What a good idea! Ideologies and frames in social movement research. Pages 185-203 in H. Johnston, Noakes, John A. , editor. Frames of protest: social movements and the framing perspective. Rowman & Littlefield Publishers, Inc., Oxford, UK.

Ostrom, E. 1990. Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press, Cambridge,MA.

Ostrom, E. 1998. A behavioral approach to the rational choice theory of collective action presidential address, American Political Science Association, 1997. The American Political Science Review **92**:1-22.

Ostrom, E. 1999. Coping with tragedies of the commons. Annual Review of Political Science **2**:493.

Ostrom, E. 2000. Collective Action and the Evolution of Social Norms. Journal of Economic Perspectives **14**:137-158.

Parson, T., and E. Shils 1951. Toward A General Theory Of Action. Harvard University Press, MA.

Pavlov, P. M. 1988. Health risks to humans and domestic livestock posed by feral pigs Sus scrofa in North Queensland. Pages 141-144. The 13th Vertebrate Pest Conference. University of California, Davis, CA.

Pimbert, M., and J. Pretty. 1994. 'Parks, people and professionals: putting "participation" into protected area management. Discussion Paper No. 57. . UNRISD, Geneva.

Plummer, R., and D. R. Armitage. 2007. Charting the new territory of adaptive co-management: a delphi study. Ecology and Society **12**.

Portelli, A. 1998. What Makes Oral History Different. Pages 63-74 in R. Perks, and A. Thompson, editors. The Oral History Reader. Routlege, NY.

Ramsay, B. J. 1994. Commercial Use of Wild Animals in Australia. Bureau of Resource Sciences, Canberra.

Ramsay, H. P., and A. Cairns. 2004. Habitat, distributiion and the phytogeographical affinities of mosses in the Wet Tropics bioregion, north-east Queensland, Australia. Cunninghamia **8**:371-408.

Resource Assessment Commission. 1993. Coastal Zone Inquiry Final Report. Australian Government Publication Service, Canberra, ACT.

Roacher, G. 1975. Talcott Parsons and American Sociology. Barnes & Nobles, Publishers, NY, NY.

Roberts, A., R. Aken, T. Chevaton, and J. Chevaton. 1999. Feral pigs: indigenous perspective in C. N. Johnson, editor. Feral Pigs: Pest Status And Prospects For Control, Proceedings Of A Feral Pig Workshop. James Cook University, Cairns, QLD, AUS.

Rodela, R. 2011. Social Learning and Natural Resource Management: The Emergence of Three Research Perspectives. Ecology and Society **16**.

Rolls, E. C. 1969. They All Ran Wild. Angus and Robertson, Sydney, NSW.

Russell, D., and C. Harshbarger 2003. Groundwork For Community-Based Conservation: Strategies For Social Research. Altamira Press, , Walnut Creek, CA.

Rydin, Y. 2003. Conflict, Consensus, And Rationality In Environmental Planning: An Institutional Discourse Approach. Oxford University Press, New York.

Scheff, T. J. 2005. The Structure of Context: Deciphering Frame Analysis. Sociological Theory **23**:368-385.

Schon, D. A., and M. Rein 1994. Frame Refelection. Basic Books, New York, NY.

Shriver, T. E., and C. Peaden. 2009. Frame Disputes in a Natural Resource Controversy: The Case of the Arbuckle Simpson Aquifer in South-Central Oklahoma. Society & Natural Resources **22**:143-157.

Siemer, W. F., and D. J. Decker. 1990. An Evaluation Of Public Meetings Held By The DEC Bureau Of Wildlife (October, 1989). Human Dimensions Resource Unit, NY.

Simmons, A. 1993. A Preliminary Aboriginal Cultural Heritage Survey of the Wet Tropics World Heritage Area, Innisfail District, Innisfail, QLD.

Smith, M. J. 1990. The role of bounties in pest management with specific reference to state dingo control programs. Charles Stuart University, NSW.

Sommer, B., and M. Quinlan 2002. The Oral History Manual. Altamira Press, CA.

Stankey, G. H., B. T. Bormann, C. Ryan, B. Shindler, V. Sturtevant, R. N. Clark, and C. Philpot. 2003. Adaptive management and the northwest forest plan. Journal of Forestry **101**:40.

State Land Asset Management. 2010. A Guide To Land Tenure: Under The *Land Act 1994*, Brisbane, QLD.

Steins, N. A., and V. M. Edwards. 1999. Platforms for collective action in multiple-use common-pool resources. . Agriculture and Human Values **16**:241–255.

Stoll-Kleemann, S. 2001. Reconciling Opposition to Protected Areas Management in Europe: The German Experience. Environment **43**:32.

Strauss, A., and J. Corwin 1990. Basics Of Qualitative Research: Grounded Theory Procedures And Techniques. Sage Publications, Inc., Newbury Park, CA.

Stringer, L. C., A. J. Dougill, E. Fraser, K. Hubacek, C. Prell, and M. S. Reed. 2006. Unpacking "participation" in the adaptive management of social–ecological systems: a critical review. Ecology and Society **11**:39.

Susskind, L., A. E. Camacho, and T. Schenk. 2012. A critical assessment of collaborative adaptive management in practice. Journal of Applied Ecology **49**:47-51.

Takahashi, S., and C. A. Tisdell. 1989. The trade in wildlife pig meat; Australia and Japan. The Australian Geographer **20**:88-94.

Tisdell, C. A. 1982. Wild Pigs: Environmental Pest or Economic Resource? . Pergamon Press Sydney.

Tomlinson, A. R. 1957. Bonuses for vermin control Conference on Vermin Control Agriculture Protection Board, Perth, W.A.

Townley, B. 1993. Foucault, Power/Knowledge and its relevance for human resource mangement. Academy of Management Review **18**:518-545.

Tribunal, N. N. T. 2009. Native Title:An Overview. Page 2 in N. N. T. Tribunal, editor. National Native Title Tribunal, Canberra, ACT.

Twigg, L. E., T. Lowe, and G. Martin. 2007. Bait consumption by, and 1080-based control of, feral pigs in the Mediterranean climatic region of south-western Australia. Wildlife Research **34**:125-139.

United Nations. 1997. Earth Summit: UN conference on Environment and Development 1992. Department of Public Information, UN, NY, NY.

United Nations. 2009. Earth Summit Agenda 21: The United Nations Programme of Action From Rio 2002. United Nations, NY, NY.

Wasserman, S., and K. Faust 2007. Social Network Analysis: Methods and Applications. Cambridge University Press, NY,NY.

Yow, V. 1994. Recording Oral History: A Practical Guide for Social Scientists. Sage Publications, Inc., CA.

Zivin, J., B. M. Hueth, and D. Zilberman. 2000. Managing a Multiple-Use Resource: The Case of Feral Pig Management in California Rangeland. Journal of Environmental Economics and Management **39**:189-204.

Chapter 5

Conclusions And Future Directions For The Evaluation Of Socio-Ecological Systems

The evaluation of stakeholder beliefs and actions in regard to the use of the feral pig resource in the Cassowary Coast Regional Council (CCRC) can provide insight into the feral pig management system. My research has shown how frame analysis can be used as an effective vehicle for understanding stakeholder positions and relationships in the presence of intractable conflict (Gray 2003; Lewicki et al. 2003; Rydin 2003). This examination of stakeholder profiles and perspectives, socio-political relationships, management resource use, and the impact of ecological and equilibrium resilience on perceptions of the feral pig socio-ecological system all contain elements that are relevant to the management of many natural resource issues.

'Identity' and 'whole story' frames can be used to learn about the fundamental principles of stakeholders entrenched in intractable environmental conflicts (Gray 2003; Ostrom 1990). Chapter 2 examined the beliefs and value of hunters, farmers, TOs, and managers, and demonstrated the areas in which these beliefs and values were shared and those in which there was disparity between stakeholders.

The use of 'characterization', 'power', and 'social control frames' can assist the examination of stakeholder socio-political relationships. Chapter 3 described the interactions that occur between resource users with different management values and beliefs. A lack of solidarity influenced negative stakeholder stereotypes particularly between groups that shared the weakest and/or the most negative relationship ties. These stereotypes served to exacerbate an already challenging management situation by creating illusory barriers to the management of pig populations. The stereotypes served to mask important similarities in beliefs between groups and

encouraged conflict as the stakeholders focused on the differences between them rather than performing management as a shared challenge to be negotiated.

Finally, 'conflict management frames' assisted with the evaluation of stakeholder use of management resources and provided an understanding of stakeholder perceptions of equilibrium and ecological resilience in management processes. Chapter 4 demonstrated areas in which the actions of disparate stakeholder groups could complement each other or else act to disrupt the management of the feral pig resource.

Future Directions

Socio-ecological systems are known for their complex interplay of social and ecosystem interactions (Berkes and Folke 2000; Cumming et al. 2012; Janssen 2011). When managing such systems, the presence of a moving resource and multiple stakeholder groups with differing value systems, such as in the case of feral pig management, can ignite intractable conflict. My study suggests that there is a need for greater focus on research and management processes in order to better integrate relevant stakeholders into management practice. In addition, managers need not only consider the role of local stakeholders in the management process, but also their own roles and the impact of their knowledge and value systems both on other stakeholders and on the development of management plans. The use of frame analysis, social structure analysis, the review of stakeholder connections to resources, and concretized definitions of participation may assist such processes. Frame analysis also assists in the process of re-framing conflict in order to help defuse the tensions between stakeholders that hinder the development of successful management outcomes. These considerations are particularly relevant to the management of threatened protected areas; there is a need to consider the fundamental internal influences that

cause poor management outcomes. The feral pig resource landscape has been divided, in part, due to the two dominant management philosophies employed by managers and local stakeholders. These are based on principles of equilibrium resilience and ecological resilience respectively. This same kind of division may be a principle cause of the presence of threatened protected areas.

During the course of this study, I evaluated the values and beliefs of managers up to the level of regional governing bodies, but it would also be useful to further investigate the perception of managers at the state and federal levels. There is always use for further examination of the ecological effects of pigs on the environment as many studies still provide primarily anecdotal information. It would also be useful to examine new management strategies for the control of feral pigs including the consideration of precautionary principles for management practice rather than short-term, cost-benefit analysis. It would be interesting to consider how management practices employed on the ground differ from those proscribed by formal policy. There is a need for improved policy that accounts for the temporal dispersal of management costs and provides methods for maintaining the spatial integrity of the landscape in management practices despite the current political landscape divisions.

The Next Steps

Dissemination of information appropriate to all stakeholders is important to the ethics of action research (AR; Cornwall and Jewkes 1995; Greenwood and Levin 1998). I hope to circulate the information collected here through a variety of communication methods such as scientific publications and popular magazines, personal communication, and possibly through the use of local radio or television in the CCRC. I also plan to write additional articles regarding

particular stakeholder groups to better share their knowledge within the wider community. The articles included in this dissertation will be reformatted into a version appropriate for lay audiences and will be provided to hunters, farmers, and TOs so that they may conduct a final review and provide feedback. This will be followed by a search conference to be held over a two to three day period with all interested stakeholders in the CCRC community particularly hunters, farmers, TOs, and managers.

A search conference is a group meeting held with all interested participants to discuss participatory methods for collective planning and action design for solving problems relevant to those involved (Greenwood and Levin 1998; Rehm et al. 2002). The search meeting will facilitate development of an action plan, another important component of AR. The stakeholders participating in the search conference and I will determine the content of the action plan. The action plan will be based on the results of this study and the action plan will be presented to CSIRO and Terrain. This will hopefully open up opportunities for these stakeholders to come together at a future time to discuss how the action plan might be integrated into the management regime of feral pigs in the CCRC.

Literature Cited

Berkes, F., and C. Folke 2000. Linking Social and Ecological Systems. Cambridge University Press, Cambridge, UK.

Cornwall, A., and R. Jewkes. 1995. What is participatory research? Social Science and Medicine 41:1667-1676.

Cumming, G., P. Olsson, F. Chapin, and C. Holling. 2012. Resilience, experimentation, and scale mismatches in social-ecological landscapes. Pages 1-12. Landscape Ecology. Springer Netherlands.

Gray, B. 2003. Framing of Environmental Disputes. Pages 11-34 in R. Lewicki, B. Gray, and M. Elliot, editors. Making Sense of Intractable Environmental Conflicts: Concepts and Cases. Island Press, Washington, D.C.

Greenwood, D. J., and M. Levin 1998. Introduction to Action Research: Social Research for Social Change. Sage Publications, Inc., Thousand Oaks, CA.

Janssen, M. 2011. Resilience and adaptation in the governance of social-ecological systems. International Journal of the Commons 5:340-345.

Lewicki, R., B. Gray, and M. Elliot, editors. 2003. Making Sense of Intractable Environmental Conflicts: Concepts and Cases. Island Press, Washington, D.C.

Ostrom, E. 1990. Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press, Cambridge, MA.

Rehm, R., N. Cebula, F. Ryan, and M. Large 2002. Futures that work: using search conferences to revitalize companies, communities, and organizations. New Society Publishers, Gabriola Island, BC, Canada.

Rydin, Y. 2003. Conflict, Consensus, And Rationality In Environmental Planning: An Institutional Discourse Approach. Oxford University Press, New York.

Appendix 1

Sample Oral History Interview Guide

- Family background/demographic information
- Tell me about your first experiences with pigs?
- Tell me about your current experiences with pigs?
- Who's involved in pig management?
- Who should be involved in pig management?
- What is your relationship with:
    - Farmers,
    - Hunters,
    - Traditional owners
- What are managers doing well?
- What should managers do differently?
- What do you do to manage pigs?
- What would you like to be doing about pig management?
- What kinds of problems or challenges do you face when you want to hunt? or when you want to manage pigs on your property? or What kinds of problems or challenges do you face from pigs?
- What are your thoughts on the pig management programs that were run in the area?
- How did the Queensland State Water Quality study affect your views about pig management?
- If you were in my shoes interviewing people, what would you ask; what would you want to know more about?

Appendix 2

Sample Individual Interview Guide

- What is your background?
- How long have you worked for …?
- What is your position and responsibility?
- What are the limits to your position?
- Where does your funding come from?
- What is your funding allowance?
- What are your thoughts on pigs?
- What is your relationship to pig management?
- What is your experience with pig management?
- Can you provide examples?
- What are the kinds of problems and challenges you face in managing pigs?
- Who is responsible for pig management?
- Who **should or should not** be responsible for pig management?
- How should feral pigs be managed?
- What is your relationship with the community?
- What is your relationship with:
    - Farmers
    - Hunters
    - Traditional owners
- If you were in my shoes interviewing people, what would you ask; what would you want to know more about?